



**Skill India**  
वीरम माता - कर्म माता



भारत सरकार  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP

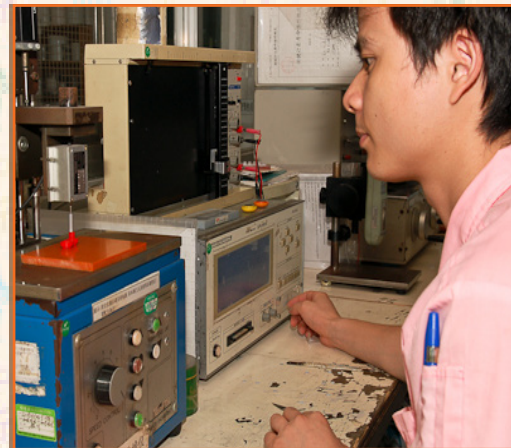


**N S D C**  
National  
Skill Development  
Corporation

Transforming the skill landscape



# Facilitator Guide



Sector  
Rubber

Sub-Sector  
Rubber Manufacturing

Occupation  
Production

Reference ID: RSC/ Q 0831, Version 1.0  
NSQF level: 4

## Junior Rubber Technician/ Technical Assistant

**Published by:**

All Rights Reserved,  
First Edition, March 2016

**Printed in India at**

**Copyright © 2016**

**Rubber Skill Development Council**

PHD House (4th Floor), Opp. Asian Games Village,

Siri Fort Institutional Area, New Delhi - 110016

Tel: +91 11 41009347, 41009348

Fax: +91 11 41004899

Email: info@rsdcindia.in

**Disclaimer**

The information contained herein has been obtained from sources reliable to Rubber Skill Development Council. Rubber Skill Development Council disclaims all warranties to the accuracy, completeness or adequacy of such information. Rubber Skill Development Council shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in Rubber Skill Development Council shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the Rubber Skill Development Council.





**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. ”



## Acknowledgement

Rubber Skill Development Council (RSDC) acknowledges the contribution of all the individuals and organizations who have contributed in the preparation of this manual.

We would like to acknowledge the efforts of our Governing Council members and RSDC Content Committee members as well as our Industry Partners who guided preparation of the manual.

Sincere appreciation is extended to all experts who had provided subject matter inputs and reviewed the individual modules. The efforts of Team Talento is specially appreciated for supporting the development of the manual.

The preparation of this manual would not have been possible without the strong support of Rubber industry, there extremely valuable feedback and inputs.

We are grateful to organizations like; Rajarshi Rubber Producer Society, Gitanjali Rubber Producer Society, PS Para Rubber Producer Society, CMC Para Rubber Producer Society, Santaram Para Rubber Producer Society and Rangmala Rubber Producer Society for their efforts in reviewing and endorsing this Participant Manual.

## About this Guide

This Participant Handbook is designed to enable training for the specific Qualification Pack(QP). Each National Occupational (NOS) is covered across Unit/s.

Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS.

- Assisting the operator in material handling in weing
- Assisting the operator in production process and equipment handling
- Assisting the operator in post production process

## Symbols Used



Steps



Time



Tips



Notes



Objectives



Do



Ask



Explain



Elaborate



Field Visit



Practical



Lab



Demonstrate



Exercise



Team Activity



Facilitation Notes



Learning Outcomes



Say



Resources



Activity



Summary



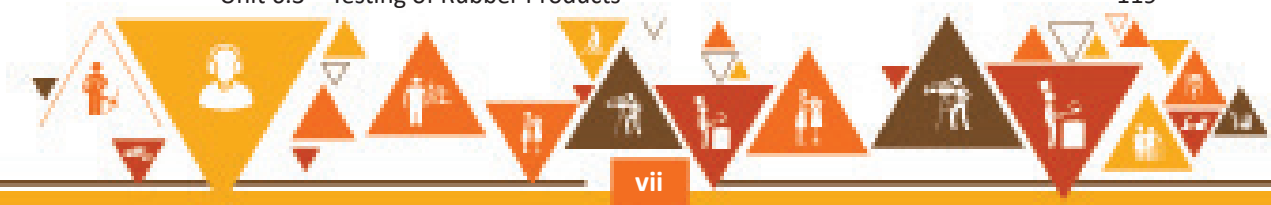
Role Play



Example

## Table of Content

S. No.	Modules and Units	Page No.
<b>1.</b>	<b>Global &amp; National Status of Rubber Industry</b>	<b>1</b>
	Unit 1.1 - Global and National Status of Rubber Industry	3
<b>2.</b>	<b>Machines Used in Rubber Product Manufacturing</b>	<b>9</b>
	Unit 2.1 - Introduction to rubber processing machinery	11
	Unit 2.2 - Mixing Mills	14
	Unit 2.3 - Internal Mixers	20
	Unit 2.4 - Extruders	29
	Unit 2.5 - Calenders	34
	Unit 2.6 - Equipments used in latex based industry	37
<b>3.</b>	<b>Maintenance and Upkeep of Machinery</b>	<b>43</b>
	Unit 3.1 - Introduction to Maintenance	45
	Unit 3.2 - Objectives of maintenance	48
	Unit 3.3 - Types of Maintenance	50
	Unit 3.4 - Familiarisation of tools	55
	Unit 3.5 - Hazards and Risks in Maintenance Activity	58
<b>4.</b>	<b>Assisting the Operator in Material Handling in Weing (RSC/N3101)</b>	<b>61</b>
	Unit 4.1 – Introduction to Material Handling Equipments	63
	Unit 4.2 – Transport Equipments	65
	Unit 4.3 – Positioning equipments	70
	Unit 4.4 – Unit Load Formation Equipments	74
	Unit 4.5 – Storage Equipments	77
	Unit 4.6 – Principles of designing and selecting material handling system	80
<b>5.</b>	<b>Assisting the Operator in Production Process and Equipment Handling (RSC/N3102)</b>	<b>83</b>
	Unit 5.1 – Standard Operating Procedures	85
	Unit 5.2 – Weighing of ingredients	89
	Unit 5.3 – Mastication, Master batching and final mixing	93
	Unit 5.4 – Extrusion and Calendering	96
	Unit 5.5 – Compression and Transfer Moulding	99
	Unit 5.6 – Injection and Miscellaneous Moulding Techniques and Moulding Equipment	103
	Unit 5.7– Post –moulding operations and Defects in Moulded Goods	106
<b>6.</b>	<b>Assisting the Operator in Post Production Process (RSC/N3103)</b>	<b>111</b>
	Unit 6.1 – Testing of Rubbers	113
	Unit 6.2 – Testing of rubber compounds	116
	Unit 6.3 – Testing of Rubber Products	119



## Table of Content

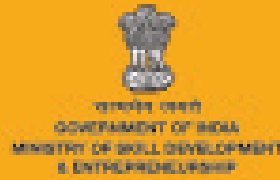
S. No.	Modules and Units	Page No.
<b>7.</b>	<b>Standards and Safety</b>	<b>127</b>
	Unit 7.1 – Standards and Specifications-Systems	129
	Unit 7.2 – Standards and Specifications-Products	137
	Unit 7.3 - Safety Aspects Related to the Machine Operation	145
	Unit 7.4 - Safety at Workplace	150
	Unit 7.5 – Good manufacturing practices- 5S concept	156
	Unit 7.6 – First Aid and CPR	160
<b>8.</b>	<b>IT Skills</b>	<b>163</b>
	Unit 8.1 - Introduction to Computer	165
	Unit 8.2 - Basic Computer Knowledge	167
	Unit 8.3 - Components of Computer	169
	Unit 8.4 - Concept of Operating System	171
	Unit 8.5 - MS Word	173
	Unit 8.6 - MS PowerPoint	175
	Unit 8.7 - MS Excel	177
	Unit 8.8 - Internet Concepts	179
<b>9.</b>	<b>Employability &amp; Entrepreneurship Skills</b>	<b>181</b>
	Unit 9.1 – Personal Strengths & Value Systems	185
	Unit 9.2 – Digital Literacy: A Recap	202
	Unit 9.3 – Money Matters	207
	Unit 9.4 – Preparing for Employment & Self Employment	212
	Unit 9.5 – Understanding Entrepreneurship	216
	Unit 9.6 – Preparing to be an Entrepreneur	232
<b>9.</b>	<b>Annexures</b>	<b>241</b>
	Annexure I: Training Delivery Plan	242
	Annexure II: Assessment Criteria	255







**Skill India**  
वीक्षण मरण-सुखम मरण



# 1. Global and National Status of Rubber

Unit 1.1 – Global and National Status of Rubber Industry



## Key Learning Outcomes

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

1. Understand the global rubber industry
2. Understand the rubber industry in India
3. Know the various advantages of rubber

## UNIT 1.1: Global and National Status of Rubber Industry

### Unit Objectives

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

1. Understand the global rubber industry
2. Understand the rubber industry in India
3. Know the various advantages of rubber

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Welcome the participants to the program
- Introduce yourself to the participants mentioning about you, your name and work experience.
- Before starting the session tell them what they are going to learn in this program.

### Say

- Tell them that they are going to learn about Global Rubber Industry.

### Elaborate

- Tell them – Rubber has been used across the world, from time immemorial, from humble beginnings of use as an eraser (suggested by noted explorer Magellan), today rubber is used across various industries like auto, aviation, healthcare, etc. which drive the economy. With origins in Brazil, today, rubber in its natural and synthetic forms is used across the world.
- Top 4 rubber producing countries are: (Natural Rubber only):
- Thailand -31%
- Indonesia-28%
- Malaysia-9%
- India-8%

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual Page No. 4 and explain trainees' the concept.

### Say

- Tell participants about the key facts and figures on natural rubber across the world. More than 90% of rubber production is in SE Asia (70% captive), namely Thailand, Indonesia and Malaysia. The tyre industry is almost the major user of natural rubber

### Elaborate

- Tell them - 70% of NR produced worldwide is used by tyre industry; the remaining 30% is mainly destined to the producers of general rubber goods made for the automobile, construction, and pharmaceutical industries in particular. Rubber is used as a necessary raw material in strategic sectors, such as transport, medical treatment, childcare etc. Global demand for rubber is significantly increasing: emerging countries in SE Asia (namely China, India and Indonesia) becoming the major consumers.

### Say

- Now tell participants about the advantages of the Industry.

### Elaborate

- **Tell them –**  
The Industry has certain distinct advantages like:
  1. The area under rubber plantations in India is ranked sixth globally
  2. India ranks fourth in the world natural rubber production
  3. India is ranked second in the consumption of natural rubber, behind China
  4. India is the top ranked nation globally in terms of productivity
  5. Indigenous availability of the basic raw materials, like natural rubber, synthetic rubber, reclaim rubber, carbon black, rubber chemicals, fatty acids, rayon and nylon yarn and so on.
  6. Fairly large domestic market.
  7. Availability of cheap labor.
  8. Training facility in various technical institutes.
  9. Rapid growth of automobile sector

**Range of Products**

The wide ranges of rubber products manufactured by the Indian rubber industry are –

1. Auto tyres
2. Auto tubes
3. Automobile parts
4. Footwear
5. Belting
6. Hoses
7. Cycle tyres and tubes
8. Cables and wires
9. Camel back
10. Battery boxes
11. Latex products
12. Pharmaceutical goods

**Hi-tech industrial products**

The important areas which the industry caters to include are -

1. All the three wings of defense
2. Civil
3. Aviation
4. Aeronautics
5. Railways and agriculture transport
6. Textile engineering industries
7. Pharmaceuticals, mines, steel plants

**Exports:** India's exports of rubber products, including tyres exceed Rs.9600 Crores.

The range of products exported is:

1. Automotive tyres and tubes
2. Rubber and canvas footwear
3. Cycle tyres
4. Pharmaceutical goods
5. Rubber hoses, cots & aprons
6. Belts and beltings
7. Sheeting

**Some rubber industry players in India:**

## Say

- Now tell participants about the rubber production in India. India's production peaks in the final months of the calendar year, and in December 2012 production was up by nearly 18 per cent month on month.

## Elaborate

- Tell them – Medium-term prospects for Indian rubber production are promising, partly because the government is committed to expanding the country's rubber-producing capacity. By the end of the 12th Five Year Plan in March 2017, it hopes to bring an additional 60,000 ha under cultivation.

### Key facts:

- Kerala is the single largest rubber producing state in India accounting for 91 per cent of total NR production.
- Kerala and TN are considered to be the traditional rubber growing regions in the country.
- In recent years, among non-traditional region, Tripura and Assam have witnessed growing production of NR.
- Non-traditional areas so far identified as almost fully or marginally suitable for rubber cultivation are Arunachal Pradesh, Assam, Manipur, and lower reaches of hills of Meghalaya, Mizoram, Nagaland and Tripura, excluding the other states of India.
- Rubber has been identified as one of the thrust areas in Tripura, in view of its suitability to the terrain and the acceptability amongst the people. Studies have shown that about 100,000 hectares of area in the state can be brought under rubber plantation.
- In fact, Tripura is now considered the "Second Rubber Capital of India" by the Rubber Board.

## Do

- Introduce the participants with the Production, Import, Export and Consumption of Natural and Synthetic Rubber in India.

## Say

- Now tell the participants about the Institutional Support.

## Elaborate

- Tell them – The institutional support for the rubber sector is driven by following organizations:
  - » Ministry of Commerce
  - » The Rubber Board

» Rubber Skill Development Centre

### **The Ministry of Commerce**

The mandate of the Department of Commerce is regulation, development and promotion of India's international trade and commerce through formulation of appropriate international trade & commercial policy and implementation of the various provisions thereof.

The Rubber Board is organized under the Ministry of Commerce.

### **The Rubber Board**

The Rubber Board is a statutory body constituted by the Government of India, under the Rubber Act 1947, for the overall development of the rubber industry in the country.

### **Rubber Skill Development Council (RSDC)**

RSDC has been constituted under the aegis of National Skill Development Corporation (NSDC), in collaboration with All India Rubber Industries Association (AIRIA) and Automotive Tyre Manufacturers Association (ATMA), with the aim to identify and fulfill skill development needs in the Rubber sector. The RSDC will encourage the industry to employ skilled and certified manpower. It will create a dynamic LMIS to keep track of the labour market skill gaps, frame.

## **Notes for Facilitation**



- Ask participants about their expectations from this program.
- Summarize the main points.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.







**Skill India**  
शिक्षणं मरणं - कृषणं मरणं



## 2. Machines used in Rubber Product Manufacturing

Unit 2.1 – Introduction to Rubber Production Machinery

Unit 2.2 – Mixing Mills

Unit 2.3 – Internal Mixers

Unit 2.4 – Extruders

Unit 2.5 – Calendars

Unit 2.6 – Equipment's used in Latex based Industry



## Key Learning Outcomes

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

1. Understand different machineries used in rubber processing
2. Identify various machines used in rubber processing
3. Understand and identify mixing mills in rubber processing
4. Understand mixing mill operation
5. Identify and understand internal mixers
6. Understand functioning of internal mixers and mixing methods
7. Understand pre-mixer and post-mixer area equipment
8. Understand extruders and types of extruders
9. Understand combination of extruders and major parts of extruders
10. Perform and understand extruder operation
11. Understand calendar machines and calendaring process
12. Understand classification of calendar and major parts of calendar
13. Perform and understand extruder operation
14. Understand different equipment of Latex based industry
15. Identify and understand equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanising unit etc.

## UNIT 2.1: Introduction to Rubber processing Machinery

### Unit Objectives

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

1. Understand different machineries used in rubber processing
2. Identify various machines used in rubber processing

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they will learn about Rubber Processing Machinery.

### Say

- Tell the participants about the Tools and Equipment. The rubber processing machinery can be classified in to 4 and mills form a part of the category of equipment's that have been used to mix compounds. Mills are also used for various other applications such as warming, holding and feeding wherein the mills are provided with certain features which make it capable of doing the specified job.

## Elaborate

- Tell them – The rubber mixing activity proceeds through certain basic mechanisms for incorporation and dispersion of the ingredients.
- There are various other activities and the features and attachments of the mills are different to facilitate it.
- In this section, we will be discussing various machineries that are used to process the rubber compounds to make articles out of rubber compounds.

Such processing equipment's of rubber generally can be classified into 4 types Viz.,

- Mixing equipment's: These are equipment's that are used to mix the compound out of selected ingredients. The examples are Mills, Internal Mixers, kneaders etc
- Shaping equipment's: Shaping equipment's are used for shaping the rubber compound into the required definite shapes which is then used to make the articles. Extruders are typical members of this group.
- Coating equipment's: Coating equipment's are used to coat the substrate with the rubber compound dough or rubber compounds which are warmed up to the required levels of plasticity.
- Moulding equipment's / Vulcanising equipment's: In many cases converting the rubber compound into final shape and setting it in the shape is a simultaneous operation.

We will try to familiarise with the important members of these various rubber processing equipment's in a few sessions from now.

## Say

- Now tell the participants about the Mixing equipment's. Having decided the formula (list of ingredients that should be added with the rubber to modify the properties of rubber) the next task is to make a uniform mix out of the selected ingredients by incorporating it in to the rubber matrix.

## Elaborate

- Explain – Early in the history of rubber compounding, it was found that kneading or softening of elastomer was helpful to reduce the incorporation time of powders into the rubber.
- Functionally, mixing equipment's help to incorporate these compounding ingredients into the basic matrix which is the rubber itself. The mixing of the ingredients in to a rubber compound can be visualized as sum of the following activities happening one after the other or more or less simultaneously.
- Consolidation
- Mastication
- Incorporation
- Dispersion
- Plasticization
- Distribution

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 18 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Unit 2.2: Mixing Mills

### Unit Objectives

At the end of the unit, students will be able to:

1. Prepare the seeds for germination.
2. Prepare the land and germination beds.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Mill Guide
- Mill Rolls
- Blender Rolls
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they will learn about the Mixing Mills in rubber processing and Mixing Mill operations.

### Say

- Tell them that the Mills are probably the oldest rubber processing machinery. Since the time of invention that rubber property can be manipulated by addition of suitable ingredients, probably mills were in use and of course, with refinements as time passed.
- Also discuss about the functional parts of a Mill and simultaneously see how these mechanisms are taking place during the mixing of the compound.

## Elaborate

- **Tell them** – Mills are probably the oldest rubber processing machinery.
- **Functionally**, mills help to incorporate three compounding ingredients into the basic matrix which is the rubber itself when it is used for mixing.
- **Let's familiarize** with the functional parts of a Mill and simultaneously see how these mechanisms are taking place during the mixing of the compound.
- **Rolls:** A mixing mill is made of two rolls sufficient in strength, sufficient in size, to hold the compounds in it.
- **Roll Bearings:** the rolls are mounted on either sides using journals or bearings and are abundantly lubricated to reduce the heat generation at the bearings.
- **Mill Frame:** The rolls through the journals are locked inside a rectangular metal structure called the mill frame placed at both the ends of the rolls.
- **The Mill Nip and Control:** In mill mixing the work is done at the gap between the two rolls called 'nip'.
- Generally there is no provision in mills to separate the rolls. It is done by loosening the adjustable screws and running the material through the nip whereby it separates the rolls till it gets loaded against the screws.
- **Mill Guides:** Mill guides or stock guides (also called end dams) serve to prevent the stock from going to the edges of the roll to get contaminated by the likely materials such as remains of the earlier batch compound or grease or such substances.
- **Mill Tray or Mill Pan:** Mill tray is a shaped metal vessel kept underneath the mill rolls and between the mill frames to collect any dripping of materials from the batch that is handled by the mill.
- **Mill Drive Train:** You will appreciate the fact that the rolls are to be rotated in opposite direction to push the rubber through the nip.

The connecting gears are supported on the roll necks, and on most mills are straight spur gears. The gears are special and are cut deep to prevent the risk of disengagement at the time of opening of the nip.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 20 - 24 explain trainees' the concept.

## Say

- Tell participants now they will learn about Mill Operations. The mills are operated by working on the front roll. It is the slower roll near which the Mill Operator stands. As a rule in all the mills where there is a manual intervention, the gear system is organized to give the front roll as the slow roll. It is on this roll that the stock forms the band (carpet) and the Mill Operator works. The front rolls therefore will have to be plain facilitating cutting and cross feeding the stock that is being worked. The rear roll can be either plain or serrated depending on the application.
- Also tell participants about the job role of a Mill man.

## Say

- Tell participants about the Categorization of Mills. Mills are used for various purposes by the industry, and mixing is just one of them. Of late the mixing for reasons that we will see in the next session, is being discontinued from mills and internal mixers are used instead. However, to handle the discharge of the internal mixers, mills are used. Likewise there are several applications of mills in the industry, and we will try familiarizing with a few of them.
- Now tell them about the Mixing Mills.

## Elaborate

- Typical values for these variables could be as follows approximately:

Mill mixing is a manual operation to create a homogeneous rubber compound with uniform properties at all parts of the compound. It is done by making a band of the rubber compound on the mill roll and adding the ingredients as specified by the formula one by one into the rubber compound.

### Typical values for these variables could be as follows approximately:

Mill size	: 24X60 inches to 26X84 inches
Motor and Gear Box HP	: 125 to 200 HP depending on the type of stock Surface Speed : 25 MPM to 40MPM
Friction Ratio	: 1.00:1.08 to 1.0:1.10
Cooling water requirement	: 150-200LPM approx (Water at ambient temp).

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 26 explain trainees' the concept.

## Say

- Tell participants about the Sheeting out (Batch of Mills). These are mills that are used underneath mixers such as internal mixers and kneaders which discharge the output in a junk form. It is important to sheet the stock immediately to facilitate cooling and also proper storage and handling of the material.

## Elaborate

- **Explain** - These are mills that are used underneath mixers such as internal mixers and kneaders which discharge the output in a junk form. It is important to sheet the stock immediately to facilitate cooling and also proper storage and handling of the material. The discharge of the mixer equipment is made to dump onto a mill and it is allowed to band on the mill roll.
- These mills generally handle stocks at a relatively high temperature and mostly stocks which are plasticized sufficiently as a result of the mixing in the upstream equipment. Accordingly they need to have a relatively



low capacity motor. Incorporation /dispersion/plasticization is not expected to take place on these mills and the mission will be to cool the stocks as early as possible.. It may be better to use larger mills considering the likely discharge quantities, from the mixer equipment.

Mill size	:	24X60 inches to 28X100 inches
Motor and Gear Box HP	:	100 to 180 HP depending on the type of stock Surface
Speed	:	25 MPM to 30 MPM
Friction Ratio	:	Even to 1.00:1.08 typical
Cooling water requirement	:	150 LPM approx (Water at ambient temp).

### Say

- Tell participants about the Warm up Mills or Cracker Mills or Breakdown Mills. In the second phase of rubber goods making, we have seen that the rubber compounds need to be shaped into a suitable form. To shape the compound using processes such as extrusion and calendaring they need to be pre- warmed and the general practice of the industry is to make use of mills to do this activity. Such mills used to warm up the stocks to make it suitable to be fed to the extruders and calenders, is called a warm up mills or cracker mills.

### Elaborate

- Tell them - The cracking rate often affects the productivity of the calender or the extruder. Therefore cracking mills are provided with special features such serrated rolls to enhance the speed at which it cracks or warms the compound. Serrated or fluted rolls are rolls that have a fluted roll surface as seen in the picture below. They offer extraordinary grip on the compound and makes the breakdown or warming of the compound faster. The compound will have to be cut and cross fed in the mill while being warmed up which is not possible with a serrated roll., Therefore only the rear rolls will be fluted, and the front roll will be a plain roll.
- In many factories, warm up mills are placed either in tandem or parallel to enhance the cracking rates.

Mill size	:	24X60 inches to 28X100 inches (as required by the main equipment)
Motor and Gear Box HP	:	100 to 180 HP depending on the type of stock Surface Speed
		: 25 MPM to 30 MPM
Friction Ratio	:	Even to 1.00:1.08 typical
Cooling water requirement	:	150 LPM approx (Water at ambient temp).

### Say

- Now the participants will learn about the Hold Mills or Blending Mills.

## Elaborate

- Now tell them - In a process that uses warmed stock for the next operation, some mills are used to hold the warm compound for a short while enroute to the main machine. Such mills are called Hold mills. This arrangement of mills is used when the amount of compound to be handled is fairly large, depending on the end requirement. It facilitates an additional blending of the stocks from different warm up mills so that the feed material is more uniform. The mill features are more or less similar to the warm up mills

Mill size : 24X60 inches to 28X100 inches (as required  
by the main equipment)

Motor and Gear Box HP : 100 to 180 HP depending on the type of stock

Surface Speed : 25 MPM to 30 MPM

Friction Ratio : Even to 1.00:1.08 typical

Cooling water requirement : 150 LPM approx (Water at ambient temp).

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 27 explain trainees' the concept.

## Say

- Now tell the participants about the Feed Mills. These are mills intended to feed the compound continuously to the main production equipment.

## Elaborate

- Now explain - These are mills intended to feed the compound continuously to the main production equipment. They are provided with takeaway and feeding devices. Feed mills also are provided with stock blenders so that the feed uniformity is better with respect to viscosity and temperature.
- Of late the nature of the mill operations for cracking, holding and feeding is changing from discrete to a more or less continuous nature. This is achieved by metering the in-feed to the mill using suitable devices such as auto-stock loaders and continuous feeding conveyors. The output also is continuous using take away conveyors.

## Notes for Facilitation

Summarize the main points.

- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

- Divide the class into four equal groups.
- Tell the participants they have to demonstrate the Mill operation in the lab. They have to demonstrate every job which a mill man does on the mill.
- Tell them they would be given a time of 30 minute for preparation. The time for presentation for each group should not exceed 20 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

	Time	Resources
1. Demonstrate the work done by an mill operator	3 Hours	Rubber Compound, Cutter and Charts

## Unit 2.3: Internal Mixers

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and Understand internal mixers
2. Understand functioning of internal mixers and mixing methods
3. Understand pre-mixer and post-mixer area equipment.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Internal Mixer
- Mill Guide
- Tangential and Intermeshing Rotors
- Hopper
- Star Bale Cutter and Straight Bale Cutter
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they will learn about the Internal Mixers and Mixing methods. Also, they will get to know about the pre-mixer and post-mixer area equipment.

### Say

- Tell participants about the Internal Mixer. The first equipment to mix compound was the mill. However owing to the productivity, safety and quality concerns that were associated with the mill operations, they were subsequently the concept of internal mixing came up. The internal mixers require pre and post mixer

installations to make use of the mixers efficiently and meeting the design requirements. These installations and their features are also discussed in this session.

- Also discuss with them about the development of Internal Mixer

## Elaborate



- Tell them - 'Internal mixing' was a revolutionary new concept in mixing. In most simple terms, it was adding a rugged cover over and underneath the two rolls of a mill, so that the ingredients of the mix were well contained inside the cover. However the mixing could have only become more inefficient in such an arrangement.
- The most significant development in this line was by Fernley H Banbury, an electrical engineer of Purdue University of the USA, called now as 'Banbury Mixer', the original patent for this machine was obtained in the name 'machine for treating rubber and other heavy plastic materials'.
- While the first Banbury® machine was put into commercial operations since 1917, the next major development in the history of internal mixing took place in the year 1932 when another model of internal mixer - named 'Intermix®' was commercialized.
- The concept of internal mixing and the success of the two machines improved the mixing productivity substantially.

### Kneaders

There is yet another class of internal mixers called Kneaders. Kneaders vary significantly in its ability to generate the shear rates required for compounds that are used by the tyre and retread rubber industry.

Traditional kneaders have two counter rotating rotors with each mixing rotor having two wings affixed on it. The two wing rotors typically rotate at different speeds through connecting gears.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual Page No: 30, 31 and explain trainees' the concept.

## Say



- Tell the participants about the Functional parts of Internal Mixer. Now, that we have understood the design concept or philosophy of internal mixers, let's examine the features of the two major designs of the internal mixers. Whatever is the design of internal mixers, based on the function that they do, the essential parts of the machine are the same and the difference is in the design details of those components.

## Elaborate



**Describe** - Based on the concept, we may list the parts of the machine as:

1. Hopper door for feeding of the stock inside
2. Floating weight that holds the rubber firmly into the locus of the rotors.
3. Chamber of holding the stock inside

4. Rotors that work on the stock.
5. Discharge door for discharging the stock from the chamber
6. Dust stop seals.
7. Motors and Gearbox for driving the rotors
8. Temperature Control Units (TCU)

**The Hopper:** The hopper consists of a hopper opening and door followed by a chute for loading the materials into the mixing chamber.

**The floating weight (Ram or Plunger):** InterMix® as well as Banbury® mixers have a movable component generically called as the floating weight or piston, which can be raised or lowered allowing the raw materials to be added into, and also force the added materials into the mixing chamber. It is also named as ram, (Banbury® mixer) or a Plunger (InterMix®)

**The Mixing Chamber:** The mixing chamber that houses the rotors inside it, receives the ingredients of the mix through the hopper chute and holds the materials during mixing.

The mixing chamber of an internal mixer can be considered to be made of two pieces of 'Drilled Sides' and two pieces of 'End Plates'.

**The Rotors:** The mixing chamber of both InterMix® and Banbury® mixers contains two counter-rotating rotors for the intensive and extensive mixing of the compound once the materials are inside the chamber.

**The Discharge Door:** The discharge door, as the name indicate, let the mixed compounds to be discharged from the mixer.

**The Dust Stop Seals:** The internal mixers are very heavy duty equipments where severe mixing action under high pressures take place and therefore tend to leak the ingredients out of the chamber through the clearance that the rotor collars make with the end plates.

There are two prominent designs of dust stops in Banbury® mixer (namely the SSA (Self Sealing Assembly) and FYH (Forced Yoke Hydraulic). SSA is also a well known Farrel dust stop.

**The Motor and Gearbox:** Internal mixers are driven by huge prime movers through appropriate reduction gears.

**The Temperature Control Unit:** The energy expended in mixing is manifested in the form of heat that the batch acquires during the mix cycle.

The modern TCU are multi-cell units and are capable of supplying water at multiple specified temperatures, so that various parts of the machine can run with separate temperatures if required.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 33-37 explain trainees' the concept.

## Say

- Tell the participants they will learn about the Mixing Mechanism in Internal Mixers. In mill mixing the effort by the mill man was to predominantly lead the compounds to the centre of the mill (nip) and to make it participate in the mixing action that takes place at the nip. In internal mixers also, the basic philosophy of working on the compound remained the same except that more opportunities of creating such interfaces for compound working were designed in the mixer.

- Tell them they will now see how are the various manual actions by the mill man have been emulated in the internal mixers. Please remember Banbury® mixers use the interfacing of the rotor tip and the wall to create the nip action, where as in Intermix®, the nip action as in the mills is between the rotors. Accordingly the rotors of the former has very active rotor edges or wing tips, and the portion leading to the wing tip is designed to effect the characteristic rolling and longitudinal shear elongation as it happens in the 'catchment' area of the mill nip.

## Elaborate

**Describe** – The mixing in tangential rotor internal mixers can be visualized as taking place through the following basic mechanisms.

**Milling:** Milling is the action of the rotors wiping material through the periphery of the bore of the sides.

**Kneading:** Kneading is caused by the rotor tips when material which has been deformed by milling is carried to the center of the chamber and relaxed.

**Longitudinal Cut-back:** Longitudinal cut back is most apparent in the 2-mill mixing as the Mill Operator strips off stock from the mill roll and feeds back elsewhere along the roll.

**Lateral Overlap:** Lateral Overlap is the action by which a portion of the material in front is pushed over into the opposite chamber or side, and is then worked in with material in front of that rotor until such time as some of it is again pushed back to the other rotor.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 38 explain trainees' the concept.

## Say

- Tell the participants about the Mixing Methods in Internal Mixers. Depending on the sequence of addition of ingredients the mixing technologist can arrive at a variety of mixing methods and decide on the most suitable one considering the process aspects of motor capability, cycle time, ease of handling on mill, and the performance aspects of dispersion, physical properties etc.

## Elaborate

**Conventional Method:** Developed originally for Natural rubbers, consists of adding the elastomer first followed by the dry ingredients and finally the liquid ingredients, once the dry materials are well dispersed.

**Early oil addition method :** This method calls for the addition of elastomer first and the dry ingredients at the earliest.

**Upside-down mix method:** This method involves adding all ingredients into the mixer before lowering the ram and commencement of mixing.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 39 explain trainees' the concept.

## Say

- Now inform the participants about the Variable parameters in Internal Mixing. While the sequence of addition is one of the methods to manipulate the mixing activity to meet the requirements of processing and performance, there are other parameters that can be varied to obtain the best performance from an internal mixer.

## Elaborate

Discuss with the participants about the other parameters:

**Rotor Speed:** The rotor speed affects the strain cycles and the deformation rates as the compound is handled inside the chamber.

Having higher no. of mills to handle the discharge can take care of this problem of distributive mixing to some extent.

**Ram Pressure:** The main function of the ram is to keep ingredients in the mixing chamber.

**Chamber Filling:** It is in this space that the rubber and ingredients are added and the mixing action takes place. If we have filled this gap fully with materials, there would not have been any chance for the materials to move around and mix. Similarly, if it is under filled also, the available materials can not actively participate in the mixing action and therefore the mixing efficiency will be seriously impaired.

The extent to which the filling is done in internal mixing is commonly denoted by the 'Fill Factor'.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 40 explain trainees' the concept.

## Say

- Discuss with the participants about the Discharge Criteria in Internal Mixing. Time was obviously the first discharge criteria. However it suffered from the serious disadvantage of causing variations within a set of batches, since the time taken from the first to last batch varied on account of the mixing efficiency as the metal parts became hot as a result of the mixing action.

## Elaborate

**Describe** – Temperature was the second option which also failed for the reason that the first batch few batches varied from the balance because of the fact that the temperature build up in the first set of batch was lower owing to the heat that has been used to warm up the metal parts of the mixer. This gave rise to a non desirable phenomenon termed 'First batch effect'.

Power measurement opened an arena of opportunities to critically evaluate the mixing action that was progressing inside the mixer. It gave power curves against time and the optimal points of activities such as oil addition ram sweep,.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 41 explain trainees' the concept.



## Say

- Now tell the participants about the Multistage Mixing in Internal Mixing. As you came to know through the deliberations of the current topics, it is imperative to put in a high amount of energy to plasticize the raw rubber, incorporate and disperse the ingredients into the rubber matrix, and also to distribute and homogenize the mix thereafter. This makes the batch temperature to go up as the mixing action proceeds.

## Elaborate

**Tell them** - The temperature of the mix was optimally controlled during the mixing process not to let the stock to become too hot, and not hot very fast.

It is not possible to expose the rubber compound that contains sulphur and accelerator to such high temperatures. If added originally with the batch, by the time the mixing of carbon black is completed and the mix is ready to be discharged, the high temperature would have caused the stock to turn scorched and prematurely vulcanized. In order to avoid this, typically in rubber compound mixing, the chemicals are divided into two:

1. Materials that are safe to be added along with rubber and carbon black at the start of the mix and
2. Materials that are required to be kept separate to be added in to a relatively cooler batch.

The mixes are designed in such way as to have a primary stage of mixing where the high energy mixing and temperature development happens after which the stock is discharged, cooled immediately and stacked. This stage is named as 'Master Batch'

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 42 explain trainees' the concept.

## Say

- Tell the participants about the Internal Mixer – Pre and Post mixer Arrangements. Additional equipment's are required to support the functioning of internal mixers. These are required for various technological and operational aspects, and to have a full picture of these various equipment's supporting the main mixer, let's see the flow chart a mixing room.

## Elaborate

Tell them - We have seen in the earlier section that internal mixers are preferred by the industry for the various advantages that these mixers offer. All these mixers that we have discussed so far are batch process machines and they need to be periodically filled in with materials for a fresh batch, when the processing of one batch in over and is discharged.

The discharge from an internal mixer is a big chunk of mixed compound. The rotors with its optimized orientation pushes all the compounds contained inside the mixing chamber in one stretch and the discharge is therefore chunky in nature.

Internal mixers therefore, are provided with a set of ancillary equipment's to handle the stock effectively in the pre and post mixer areas. Let's now familiarise with these equipment's.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 43 explain trainees' the concept.

## Say

- Now explain the participants about the Equipment's in the Pre-Mixer Area.

## Elaborate

- Describe – Equipment's in the Pre-Mixer Area:

**Bale Cutters:** In smaller size internal mixers, the hopper door does not allow feeding of rubber bales in the full form of the bale. Synthetic rubber is supplied in an international standard 33.0 Kg bales. Sheet Natural rubber is supplied mostly in 50.0 Kg bundles.

### Weighing arrangements for chemicals

While chemical weighing is still a manual process in many of the units including major tyre units, currently many are equipped with auto-chemical weighing units. The manual method is simple and many a places it is done in a computer aided fashion to prevent errors and also to log the data of weighing for a review later.

### Weighing arrangements for bulk fillers

In small, medium and some of the large factories even, the bulk fillers such as carbon black, silica etc are weighed manually and fed through the feed hopper. This makes the area dirty and dull. In modern factories therefore, the weighing of these items are moved to another production floor and are discharged directly into the mixer chamber.

### Weighing arrangements for oils and liquid ingredients

The process oils are normally weighed and added manually in many of the units. However the handling of process oils can also be automated and can be made to charge directly in to the mixer chamber. The oils are usually kept warm at about 70-80oC.

### Weighing and feeding devices for rubbers and compounds.

The polymers (rubbers) are added into the mixing chamber using conveyors provided for the same, called Charging Conveyors. A pre-weighed quantity of rubber is to be charged into the mixer and therefore the charging conveyor is preceded by another conveyor called Weighing Conveyor.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 44 - 45 explain trainees' the concept.

## Say

- Now explain the participants about the Equipment's in the Post – Mixer Area.

## Elaborate

- Describe – Equipment's in the Post – Mixer Area:

### Discharge Dump Mill

The discharge is directly dumped into the Dump Mill. It is a mill large enough to accommodate the discharge of the internal mixer.

### Twin Screw Sheeter (TSC)

This an alternative device for sheeting out the stock discharged from the internal mixer.

### Blender Mills

When the batch off device is mill, the current practice is to use 2 or 3 mills in tandem and the middle mills have provisions of stock blending on them.

### Batch off Mills

Batch of mills are the last in the series of the multiple mills that have been placed in tandem to the dump mill to handle the output of the internal mixer. In this mill the stock is allowed to band on the slow roll and a continuous sheet of sufficiently homogenized rubber compound is extracted using a batch off device.

### Slab Dip

The hot compound, which is extracted from the batch off mill is tacky in nature and tends to stick together if allowed to come in contact with the adjacent layer when stored. This is prevented by passing the mixed compound sheet through a trough of soap, mixed with water.

### Cool Rack

The soap wet rubber sheet which comes out of the Slab Dip Slurry is hung in loops in a long conveyor called Cooling Rack.

### Stackers

The cool and dry sheets of mixed compound are then stacked using a device called Stacker (Wig-Wag station) on top of a skid. It is then identified properly and moved to their respective storage area.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 46 explain trainees' the concept.

## Say

- Tell the participants about the Tandem Mixing – A new Ancillary Combination in Internal Mixing. Multiple stages mixing shall be avoided as much as possible – for better productivity.

## Elaborate

Describe – As you are aware, multistage mixing calls for energy centric efforts to cool the batch and also to warm it up to the required extent for addition of ingredients. Why not add the sulphur and accelerator in one stage itself without encountering the negative aspects of high temperature? This thought drove mix designers to a concept called tandem mixing. Let's examine the tandem mixing process in greater details.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 47 explain trainees' the concept.

## Demonstrate

Let's examine the tandem mixing process in greater details.

**Step 1 :** Mixing of the master batch. It is done in the conventional sequence (A tangential mixer or an intermeshing mixer) and the mixing is continued till the dispersion phase is completed.

**Step 2:** The RPM of the main mixer is lowered to continue the distributive mixing and the reduction in the RPM reduces the rate at which energy is put into the system with the result the stock maintains the peak temperature attained by that time, which is lower than the normal single RPM mixing.

**Step 3:** The batch is dumped into a tandem mixer (Intermeshing mixer only) kept underneath the main mixer.

**Step 4:** The batch is further dumped to a twin screw sheeter kept further underneath and batched off from it. The batch as usual is cooled and stacked. For successful tandem mixing, one has to be careful about:

- The selection of rotor geometry of the main mixer,
- Design of the tandem mixer (Since there is no ram, the rotors will have to be designed for better stock intake),
- Type of stock (softer stocks are better for this technology) , and
- Appropriate fill factor (generally low for the slow hot build up and maintenance of low temperature).

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

- Divide the class into two equal groups and name them Group A and Group B.
- Now give Group A and Group B the topics Mixer with Tangential Rotors and Mixer with Intermeshing Rotors respectively.
- Tell the participants they have to give a presentation on their respective topics.
- Tell them they would be given a time of 30 minute for preparation. The time for presentation for each group should not exceed 30 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Explain about the Mixer with tangential Rotors and Mixer with Intermeshing Rotors	2 Hours	Charts

## Unit 2.4: Extruders

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand extruders and types of extruders
2. Understand combination of extruders and major parts of extruders
3. Perform and understand extruder operations

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Extruders
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they will learn about the Extruders.

### Say

- Tell participants about the Extruders. Extruders are one of the members of the rubber processing machinery, under the category – Shaping Equipment’s. An Extruder is basically shaping equipment, in the sense that it is used for making different articles using dies. An extruder may be formally defined as “a machine designed to produce a continuous strip of material of desired cross section by forcing the material through an orifice or die”.

## Elaborate

- Tell them – The basic components of an Extruder are Screw, Barrel, Head and Die, other than Drives and Gears. An Extruder and its components are designed based on basic principle of Polymer Rheology and Visco-elastic behaviour. The operation of an Extruder calls for extra care and strict adherence to Standard Operating Procedure (SOP).

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 50 explain trainees' the concept.

## Say

Tell participants about the types of Extruders. Let us examine different types of extruders, the basic components of our extruder and the very fundamental rheological principles that govern an extrusion process.

## Elaborate

Tell them – The types of extruders based on mechanism of compound pushing are:

### 1. Ram type extruders

These are generally used for extruding compounds with poor flow properties.

### 2. Screw type extruders – Screw type extruders can be used for continuous and long profiles of any complexity.

#### The types of extruders based on type of “feed” stock

Based on the type of compound that is fed to the extruder, extruders are classified into two:

1. Hot feed extruder – Hot feed extruders are fed with pre-warmed stock from an open mill
2. Cold feed extruder – Cold feed extruders are fed with cold strips (not pre-warmed) or pellets of compound.

The other basic differences of hot and cold feed extruders will be discussed later, after our familiarisation with certain other basic terms.

Again, depending on the design of the barrel, cold feed extruders are further divided into:

1. Pin barrel extruders
2. Plain barrel extruders
3. Vacuum extruders

## Say

- Tell participants about the combination of Extruders. Combinations of extruders are also available, wherein, individual extruders are kept one over the other and output are collected out with the help of flow channels and perform dies. These types of extruders are called “piggy back”. Direct face to face combination is also commercially available.
- Also tell participants about the major parts of an Extruder.

## Elaborate

Tell them – Having studies about different types of Extruders, it is time for us to familiarize with the important components of an Extruder in general. These are components applicable to all types of Extruders.

- The barrel (cylinder): The barrel is the enclosure for the screw and facilitates the flow of stock towards the die.
- Screw: The rotating screw is responsible for forcing the stock through the die.
- The screw geometry – a little deeper: The frictional force at the barrel is the driving force for the forward movement of material inside the screw – barrel enclosure.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 52 explain trainees' the concept.

## Say

- Tell the participants about the pressure development in Extruder and output. The pressure in the Extruder varies from hopper to head and the screw speed controls the output.

## Elaborate

Tell them – The output depends on several factors like screw diameter, viscosity of the stock, temperature of the stock, the feeding, screw- barrel clearance etc.

### **The pressure development in Extruder and output**

The pressure in the Extruder varies from hopper to head and the screw speed controls the output.

**Drive:** The Extruder screw has to be rotated at a specified RPM, (Revolution per Minute) to obtain the desired output.

**Head:** The head of the extruder, as the name suggests does the function of homogenization, i.e. the head consolidates and homogenizes the compound emerging from the barrel and screw and a stock with more or less uniform temperature is fed to the die.

Initially the head must be heated so as to avoid “Cold” extrusion and after warmup, temperature must be controlled to suit the extrusion conditions with the help of Temperature Controller Unit (TCU).

The head must be free of “dead spots” and must be given the provision for circulating heating/cooling media.

**Temperature control:** The control is meant for barrel, screw, die, head, etc.

**Die:** As we have seen earlier, the compounded rubber or “stock” which is fed to the hopper of the Extruder is pushed forward with the help of the Screw and is consolidated at the ‘Head’. From the ‘Head’, the compound further travels through the die to take the final shape of the Extrudate.

Rheology deals with the deformation and flow of polymeric material. Polymers exhibit a dual behaviour in the sense that, they flow like a liquid and deform like solids.

Considering the above features of polymer in mind, let us look at the die design process.

When a compound is passed through the die, the output shrinks in the longitudinal direction and swells in the orthogonal direction.

Die surfaces are polished and beveled to get a smooth flow.

#### Terms related to extrusion die

- **Melt fracture** - When the tensile stress exceeds the tensile strength of the polymer melt, the extrudate exhibits an irregular shape and called 'Melt Fracture'.
- **Die swell** – The phenomenon of polymer swell as it leaves the die – The extrudate has different dimensions from that of the Die cross section.
- **Bambooning** – The phenomenon of the whole extrudate appearing like a Bamboo Pole – it is a type of Melt Fracture.
- **Shark skin** – it is a regular ridged surface distortion. It can be controlled by reducing the extrusion speed and increasing the die temperature.

#### Types of Dies

These are different shapes of extruded with Dies – the prominent ones are Slit dies, Strand dies, Annular dies, Open Profile dies, Hollow Profile dies, etc.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 54 - 55 explain trainees' the concept.

### Say

- Tell the participants about the Ancillary Equipment's. An extruder cannot be a standalone unit in big rubber process industries. There are a number of other equipment's to help the process of extrusion. Modern extruders are provided with online weighing and automatic rejection of "out of specification" extrudates. Online profiling, length measurement, etc., with the help of laser technology are becoming part of extruders.

### Elaborate

Tell them – As we have learnt, extrusion is one of the important activities in rubber processing industry. The extruded components form part of ultimate products like TYRES and TUBES. The amount of precision and consistency required for such products are very high. Therefore, it is very important to follow the SOP in all stages of extrusion.

#### Some of the very general areas of importance are:

- Stock warming on Mill
- Profile and weight control
- Handling of waste and re-work
- Statistical Process Control (SPC)

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 56 explain trainees' the concept.

- The L/D ratio for Cold feed extruders are (high/low).



- Mill 'bank' control is important for :
  - » Weight consistency of the extrudate.
  - » Consistent feeding of the stock.
  - » Better 'heat' history for all of the above.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

- Divide the class into three equal groups and name them Group A, B and C.
- Now give Group A, B and C the topics like 'types of extruder', 'Combination of Extruder' and 'Major Parts of Extruder' respectively.
- Assign some parts of the Extruder to each group
- Tell the participants they have to give a presentation on their respective topics.
- Tell them they would be given a time of 30 minute for preparation. The time for presentation for each group should not exceed 30 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Explain about extruder	3 Hours	Charts, Extruder, Pen

## Unit 2.5: Calendars

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand calendar machines and calendaring process
2. Understand classification of calendar and major parts of calendar

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Callender
- Roll
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Calenders in this Unit.

### Say

- Tell participants about the Calenders. Calendaring is a process of extracting a thin film of rubber compound. It can be taken out as an unsupported sheet and also as coated on a textile substrate. The equipment used for the calendaring operation is called 'Calender'.
- Discuss with the participants about the Calenders as a Rubber Compound Processing Machine.

### Elaborate

Tell them – A Calender consists of two or more oppositely moving rolls generally carried one above the other fitted in a pair of vertical frames standing on a base plate and connected by a bridge piece above the top roll. The

housing and associated structure is made as rigid as possible. Rolls are, conventionally, numbered from the top. Different sheeting gauges are possible by adjusting the gap (nip) between the rolls.

- The function of a Calender is to prepare compounded rubbers into a smooth sheet of definite thickness and width.
- The process of application of a rubber or plastic formulation that is too delicate to be calendered (due to very low viscosity), on a textile substrate is known as 'doughing' or 'spreading'.
- When it is required to produce rubber compound sheeting (thin film of rubber compound) with dimensional precision or application of the rubber sheeting on one or either sides of a textile fabric, calendars are used.
- Calenders are also used for special applications like embossing and profile calendaring.
- For a textile material to find value as a product reinforcing agent, it has to be coated with a rubber compound.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 58 - 59 explain trainees' the concept.

## Say

- Tell the participants about the classification of calenders.

## Elaborate

Tell them – Basis for the classifications of calenders are:

1. The number of rolls and
2. The position or orientation of the rolls

### **Two roll Calenders:**

Two roll calenders can be employed for the production of only rubber sheeting.

**Three roll Calenders:** 3 Roll calenders are also known as universal calenders owing to its flexibility and reliability. 3 roll calenders can be utilized for application of rubber sheeting on one of the sides of a fabric (skim coating or topping).

**Four Roll Calenders** 4 Roll Calendars provide 3 nips. Two sheeting are generated from first and third nips. Both of the sheeting can be applied on either sides of a fabric passing through the second (middle) nip. If the Calendar is expected to carry out skim coating or topping, the second and third roll should run at same speeds. (ie, the fabric and rubber sheeting should run at same speed)

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 59 - 60 explain trainees' the concept.

## Say

- Tell the participants about the parts of a calender.

## Elaborate

Tell them – Below are the parts of Calender:

1. **Frames:** Made of Iron Castings – Heavy to withstand the enormous pressure generated during processing. The frames are machined on all surfaces and therefore facilitate easy fitment of any ancillary equipment.
2. **Rolls** Calender rolls are generally made of high quality close grained cast iron, chilled on the surface to a depth of 0.75 inches, and have surface hardness of 500-520° Brinell.
3. **Temperature Control Unit (TCU):** Rolls are maintained at constant temperature by circulating temperature controlled water with the help of a Temperature Control Unit (TCU).
4. **Roll Bearings:** 2 & 3 roll Calenders generally have Journal bearings. High speed 4 Roll Z Calenders are equipped with Double Taper Roller bearings. All the bearings are pressure Lubricated
5. **Nip Control System (Screw down system):** Nip is controlled by moving individual roll using gear head motors, worm gear drives and spindles. To correct the parallel uniformity of the roll gap, motors can be run in individual modes also (ie, each side of the same roll can be adjusted). The maximum adjustment travel is limited using limit switches. There are Calenders equipped with automatic gauge control system.
6. **Drive System:** The old Calenders had drive system in which the central roll alone was driven and the rolls were in-turn driven by attachment gears. It necessarily used a DC drive. The modern Calenders are driven by a "Unidrive" system, where separate motors are provided for individual rolls. All these motors are having infinite speed control (Zero to maximum rated speed). Motors used are DC or AC with variable frequency drives
7. **Cooling Drums:** The calendared stocks should be properly cooled before wound to prevent scorching and loss in tack.
8. **Let off and wind up devices:** Fabric Calenders will have suitable let off devices to let off the fabric to be calendared at a uniform rate, and at uniform tensions.
9. **Calender gauge control:** Calenders for rubber compounds need to produce sheet of thickness in the range 0.1- 1.5 mm with a width equal to the operational surface of the roll (depends on the roll length) continuously.
10. **Roll Crowning:** To compensate this, the rolls were ground with varying diameter from center to the sides.
11. **Roll Bending:** In calendaring operations, it is possible that the deflective forces generated by the compound can go so high that the roll crowning may not be sufficient to ensure parallel uniformity of the rolls (and the nip).
12. **Axis Crossing:** Axis crossing is accomplished by tilting the plane of axis of one of two adjoining rolls in relation to the common plane axis of the two.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 61 - 63 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Unit 2.6: Equipment's used in Latex Based Industry

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand different equipment's of latex based industry.
2. Identify and understand equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanizing unit etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Cantainer
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Equipment's used in Latex based Industry in this Unit of the program.

### Say

- Tell participants about the Latex product manufacturing process. The latex product manufacturing process consists of various operations starting from compounding followed by shaping operation, vulcanization, final finishing operations & packing. Some of the equipment's are common to all kind of latex industries but some others are specific to the particular industry.
- Also tell the participant about the equipment's used to prepare dispersions.

## Elaborate

The equipment's which are used to prepare dispersion are:

1. **Ball Mill:** The general principle of adding chemicals and other substances in latex compounding is to convert solid chemicals to dispersion & water insoluble liquids into emulsions.
  - Material of the container – Porcelain, stainless steel
  - Bead material – Porcelain, Stainless steel
2. **Attritor Mill:** Here also a grinding media is used for the particle size reduction. In attritor mill, in addition to the ball, there is a reciprocating agitator fixed inside a container (porcelain/stainless steel), which ensures the total mixing of the components.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 65 - 66 explain trainees' the concept.

## Say

- Tell the participants about the equipment which are used to prepare Emulsions. Emulsions are stable suspensions of a liquid in another, the liquids being immiscible.

## Elaborate

Tell them – Stability of the emulsion is obtained by dispersion of very fine droplets of one liquid (disperse phase) through the other liquid (called the continuous phase). The stability of an emulsion is controlled by:

- Interfacial surface forces,
- Size of the disperse phase droplets,
- Viscous properties of the continuous phase and
- Density difference between the two phases.

The dispersed particles in the emulsion have a very large surface area, which is created in the process of emulsification.

The emulsifying equipment has to reduce the droplet size of the dispersed phase to very small size. This can be achieved by imposing very high shearing stresses upon the liquid that is to be dispersed

Centrifugal forces may also be used to obtain the shearing action. Discs spinning at high velocities give rise to high shearing forces in liquids flowing over them. Flow between contra-rotating discs, which may have pegs on the disc faces, can be used to produce emulsions. Designs in which small clearances are used between a stationary disc and a high speed flat or conical rotating disc are called colloid mills. In colloidal mills the shear stresses developed in the narrow gap between members moving relative to each other are primarily responsible for the comminution of the oil droplets. To ensure satisfactory refining, the clearance between the members in such mills is kept at the minimum. Another source of energy for shearing is from ultrasonic vibrations induced in the liquid ( eg Ultrasonic mill)

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 66 - 67 explain trainees' the concept.

## Say

- Tell the participants about the Latex compounding mixer. Latex compounding mixer consists of a jacketed vessel with a stirrer attached to it. The material of construction is stainless steel or FRP. Hot water is circulated through the jacket for speed up the pre-vulcanization. A geared motor is used to rotate the stirrer at low speed during chemical addition as well as during pre-vulcanization. Based up the requirement chilled water can be circulated through the jacket to bring down the temperature.

## Elaborate

Tell them – Dipping tanks in the simplest design consist of a rectangular jacketed tank where the dipping takes place. Stainless steel & FRP act can be used to construct dipping tank .It consist of two compartments separated by partition sheet & the latex is fed to the bottom compartment at the rear end & it move towards the other end (where the former is entering) through the bottom channel. An agitator is also provided in the dipping tank to keep the latex in motion in phase with the movement of the former. This also eliminates the formation of cream.

## Say

- Tell the participants about the Drying Oven. Drying oven is essential equipment in any latex industry. In continuous process industry it is a part of the main machinery and is called drying chamber. The film deposited on the former during dipping is in the wet condition & the first post dipping process is the drying which is occurring in drying booth.
- Discuss with the participants about the Leaching Tank. Leaching is the process that involves the removal of water soluble residues from the rubber film. This improves the inter particle coalescence & thus the mechanical properties.
- Also tell them about the Dehydration Unit. Dehydrator consist of meshed barrel that rotate at a lower rpm (25- 30). It is positioned at a slightly inclined angle so that the rotation will result in carrying the product forward as well water removal.

## Demonstrate

Demonstrate Vulcanization Unit to the participants. The extent of vulcanization in the final stage depends on prevulcanistaion history of latex compound used in dipping. If fully prevulcanised latex is used, the final heating is mainly for drying only. If partially prevulcanised latex is used for dipping the remaining vulcanization is done in the final stage. Irrespective of this slight vulcanization also happen in final stage heating.

## Say

- Now tell the participant about equipment's used in final finishing operation. This process is industry specific & varies widely depending upon the product.

## Elaborate

Tell them – One of the common processes is powder finishing operation which involves mixing the product with powder slurry with or without the use of silicone emulsion. Industrial washing machine & high speed spin driers (to expel the excess slurry ) is one option. Talk, MgO, Corn starch etc. can be used as the dusting powder. The powder slurry along with silicone emulsion ( if required) & product are loaded into a front open type industrial washing machine & rotated at high speed so that a thin deposit is formed on the surface which improves the surface finish as well as reduce the friction during use.

## Say

- Now tell the participant about the Latex Thread Making Machine. The basic components of a latex thread extruder machine are – a constant head reservoir for feeding the extruder, a latex extruder with nozzle made up of accurately dimensioned borosilicate capillary tube, a concordant bath into which thread is extruded, leaching bath, drying chamber with conveyer system , stretching rollers ,Lubricant bath & vulcanizing chambers, cutting unit with rotating knife arm.

## Elaborate

Tell the participants about the other miscellaneous equipment's.

### **Flocking Machine**

Flocking process involves applying short monofilament fibres, usually nylon or rayon, directly on to a substrate that has been previously coated with an adhesive ( screen printed to the surface) so as to get velvet finish.

Other techniques are spraying and transfers, vibration method etc can also be used. The spraying method is similar to spray painting, the flock is sprayed using an air compressor, reservoir, and spray gun .

### **Screen printing units**

This is used for providing decorative printing on the surface of the product especially balloons.

### **Equipment's used for packaging**

Different types of equipment's can be used for packing the product & the equipment's used depend upon the industry. Some products are packed in Poly olefin pouches while certain products are packed in multilayer laminate

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 71- 72 explain trainees' the concept.



## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

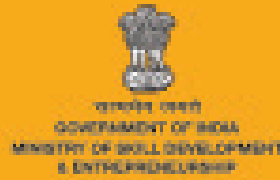
- Divide the class into three equal groups and name them Group A, B and C.
- Now give Group A, B and C the topics like 'Equipment used to prepare Dispersion', 'Equipment used to prepare Emulsion' and 'Equipment used in final finishing operation' respectively.
- Assign some Equipments related to their topics to each group.
- Tell the participants they have to demonstrate the equipments.
- Tell them they would be given a time of 20 minute for their preparation and then they finally need to demonstrate in front of the class. The time for demonstration should not exceed 30 minute per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstrate the equipments	3 Hours	Charts, equipments, marker





**Skill India**  
वीरता मर्यादा - कृषि मर्यादा



# 3. Maintenance and Upkeep of Machinery

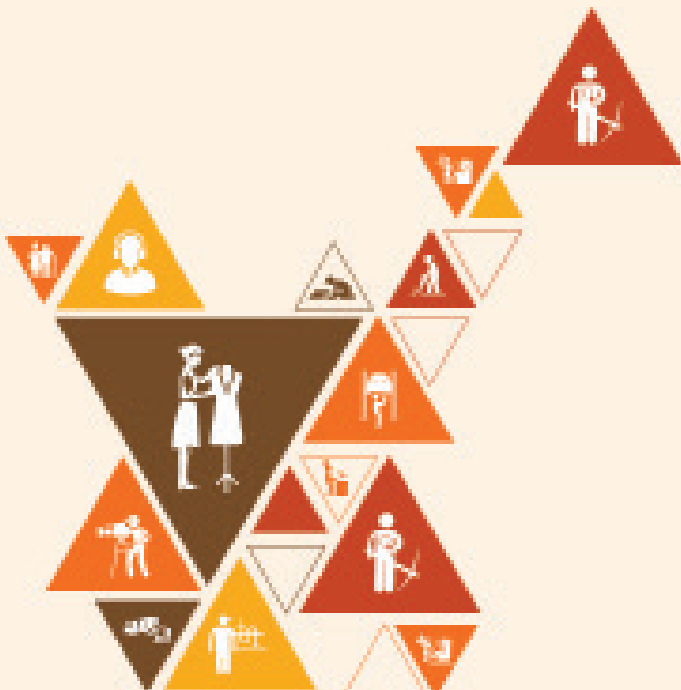
Unit 3.1 – Introduction to Maintenance

Unit 3.2 – Objectives of Maintenance

Unit 3.3 – Types of Maintenance

Unit 3.4 – Familiarization of tools

Unit 3.5 – Hazards and Risks in Maintenance Activity



## Key Learning Outcomes

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

1. Understand importance of preservation and protection of machines and equipment
2. Understand and perform maintenance of machinery and equipment
3. Understand objective of machine/equipment maintenance
4. Identify various types of maintenance
5. Perform maintenance type like RTF, PM, CM etc.
6. Familiarise with various tools (hand tools etc.) used in rubber processing
7. Identify and understand equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanising unit etc.
8. Identify various hazards and risks involved in maintenance activity
9. Act on preventive measure to avoid hazards and risks

## Unit 3.1: Preservation and Protection

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand importance of preservation and protection of machines and equipment's
2. Understand and perform maintenance of machinery and equipment

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about Preservation and Protection in this unit of the program.

### Say

- Tell the participants that the various aspects of maintenance of machinery such as, maintenance practices, methods and various hazards associated with the process will be discussed now. It briefly covers the evolution of maintenance process and its current state and importance in an industry. A Machine produces useful work so as to reduce human effort. In industries now a day, various machines run day and night and produce various items that are now integral part of human existence.
- Tell the participants about the maintenance aspects of machinery.

## Elaborate



What is a machine?

- A machine is a device consisting of fixed and moving parts. It modifies mechanical energy and transmits it in a more useful form.

Mechanization is a by-product of Industrial revolution, when demand was so high and cannot be met with human work force alone; an era of machine came into being. The various jobs were studied and where ever possible, machines were introduced to support human work force to achieve the required targets set by customer demands.

## Say



- Tell the participants about the maintenance.

## Elaborate



- Tell them about the maintenance as a noun.
- The process of maintaining or preserving someone or something, or the state of being maintained: "the maintenance of democratic government".
- The process of keeping something in good condition: "car maintenance"; "essential maintenance work".

### Synonyms

Upkeep - keeping - support - sustenance – preservation.

In simple words, maintenance is a set of organized activities that are carried out in order to keep an item in its best operational condition with minimum cost burden. Activities of maintenance function could be either repair or replacement activities, which are necessary for an item to reach its acceptable productivity condition. The driving factor behind maintenance is need for maximum output.

### Evolution of maintenance

In the period of pre-World War II, people thought of maintenance as an added cost to the plant which did not increase the value of finished product.

During and after World War II, at the time when the advances of engineering and scientific technology developed, people developed other types of maintenance, which were much cheaper. In addition, people in this era classified maintenance as a function of the production system, rather than a separate entity.

Nowadays, increased awareness of such issues as environment safety, quality of product and services makes maintenance one of the most important functions that contribute to the success of the industry.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Unit 3.2: Objectives of Maintenance

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand objective of machine/equipment maintenance

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the objectives of maintenance in this unit of the program.

### Say

- Tell the participants about the maintenance objectives. Maintenance objectives should be consistent with and subordinate to production goals. The relation between maintenance objectives and production goals is reflected in the action of keeping production machines and facilities in the best possible condition so as to ensure maximum productive hours.

### Elaborate

Tell them – Various objects of maintenance can be listed as follows:

- Maximising production or increasing facilities availability at the lowest cost and at the highest quality and safety standards.
- Reducing breakdowns and emergency shutdowns.
- Optimising resources utilisation



- Reducing downtime.
- Improving equipment efficiency and reducing scrap rate.
- Optimising the useful life of equipment.
- Providing reliable cost and budgetary control.
- Identifying and implementing cost reductions

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Unit 3.3: Types of Maintenance

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify various types of maintenance
2. Perform maintenance type like RFT, PM, CM, etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the types of maintenance.

### Say

- Tell the participants about the Run to Failure Maintenance (RFT). The required repair, replacement, or restore action is performed on a machine or a facility after the occurrence of a failure in order to bring this machine or facility to at least its minimum acceptable condition.

### Elaborate

Tell them – This is the oldest type of maintenance and is subdivided into two types:

- Emergency maintenance
- Breakdown maintenance

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and explain trainees' the concept.

**Disadvantages:**

- The operations are expensive in terms of both direct and indirect cost.
- Using this type of maintenance, the occurrence of a failure in a component can cause failures in other components in the same equipment, which leads to low production availability.
- The activities are very difficult to plan and schedule in advance.

**This type of maintenance is useful in the following situations:**

- The failure of a component in a system is unpredictable.
- The cost of performing run to failure maintenance activities is lower than performing other activities of other types of maintenance.
- The equipment failure priority is too low in order to include the activities of preventing it within the planned maintenance budget.

**Say** 

- Tell the participants about the Preventive Maintenance (PM). The maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of machine.
- Also tell the participants about the advantages of preventive maintenance activities.

**Elaborate** 

Tell them – The advantage of preventive maintenance activities are listed below:

- Satisfy most of maintenance objectives.
- Good for those machines and facilities which their failure would cause serious production losses.
- Aim is to maintain machines and facilities in such a condition that breakdowns and emergency repairs are minimised.

Its activities include replacements, adjustments, major overhauls, inspections and lubrications.

Researchers subdivided preventive maintenance into different kinds according to the nature of its activities:

- Routine maintenance
- Running maintenance
- Opportunity maintenance
- Window maintenance
- Shutdown preventive maintenance: This is a set of preventive maintenance activities that are carried out when the production line is in total stoppage situation.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 83 explain trainees' the concept.

## Say

- Tell the participants about the Corrective Maintenance (CM). In this type of maintenance activity, actions such as repair, replacement, or restore will be carried out after the occurrence of a failure in order to eliminate the source of this failure or reduce the frequency of its occurrence

## Elaborate

Tell them – This type of maintenance is subdivided into three types:

- Remedial maintenance
- Deferred maintenance
- Shutdown corrective maintenance

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 84 explain trainees' the concept.

The way to perform corrective maintenance activities is by conducting four important steps:

1. Fault detection.
2. Fault isolation.
3. Fault elimination.
4. Verification of fault elimination.

In the fault elimination step several actions could be taken such as adjusting, aligning, calibrating, reworking, removing, replacing or renovation.

Corrective maintenance has several prerequisites in order to be carried out effectively:

1. Accurate identification of incipient problems.
2. Effective planning
3. Proper repair procedures.
4. Adequate time to repair.
5. Verification of repair.

## Say

- Tell the participants about the Improvement Maintenance (IM). This type of maintenance activity aims at reducing or eliminating entirely the need for maintenance.

## Elaborate

Tell them – It is subdivided into three types as follows:

- Design-out maintenance
- Engineering services
- Shutdown improvement maintenance

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 85 explain trainees' the concept.

## Say

- Tell the participants about the Predictive Maintenance (PDM). Predictive maintenance is a set of activities that detect changes in the physical condition of equipment (signs of failure) in order to carry out the appropriate maintenance work for maximizing the service life of equipment without increasing the risk of failure.

## Elaborate

Tell them – It is classified into two kinds according to the methods of detecting the signs of failure:

- Condition-based predictive maintenance: depends on continuous or periodic condition monitoring equipment to detect the signs of failure.
- Statistical-based predictive maintenance: depends on statistical data from the meticulous recording of the stoppages of the in-plant items and components in order to develop models for predicting failures.

The drawback of predictive maintenance is that it depends heavily on information and the correct interpretation of the information.

### Advancements in Maintenance Practices

Like all other operations in manufacturing, Japanese principles have heavily influenced the maintenance activities and procedures. Total Productive maintenance is one among them

## Say

- Tell the participants about the Total Predictive Maintenance (TPM). Originated in Japan in 1971, this is as a method for improved machine availability through better utilization of maintenance and production resources. In TPM the machine operator is trained to perform many of the day-to-day tasks of simple maintenance and fault-finding. TPM is a proactive approach that essentially aims to identify issues as soon as possible and plan to prevent any issues before occurrence.
- Also tell the participants about the Autonomous Maintenance.

## Elaborate

Explain – Autonomous Maintenance (AM) is based upon operator's skills and knowledge development; it seeks to empower them to take over the daily care and easy maintenance tasks of their equipment's. Further, it leads to create autonomous teams, able to manage themselves their small unit.

- It basically involves four steps, CLIT
- Clean
- Lubricate
- Inspect
- Tighten

### The need for autonomy

- The need for enhancing operator's competencies soon rose, as the sophistication and complexity of the equipment to use rose.
- Additionally, production stoppage have growing economical and logistic impacts, as more firms go the just-in-time way and becoming sensitive links in a global supply chain, which performance is more than often related to the upstream suppliers'.
- **Maintenance done by users**

Autonomous Maintenance is an activity performed by operators, users of their production machines. Basically, AM means maintain machines in a state of tidiness and readiness by insuring:

- Cleaning and inspections to detect abnormalities and possible malfunctions
- Current tending
- Diagnostic, repair and/or facilitate maintenance experts operations
- Measure and follow-up of operations (data capture and recording, audits, failure rate survey...)
- Optimization of procedures, work guides, etc.

### Main benefits

The main benefits sought by developing autonomous maintenance are:

- Respond swiftly in case of malfunction
- Develop the stand-alone (autonomy) of night shifts, week-end shifts...
- Involve, empower and motivate operators (see also empowerment and job enrichment)
- Free techs and experts from maintenance team for working on preventive maintenance, high complexity problem solving, continuous improvement, etc.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Unit 3.4: Familiarization of Tools

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify various types of maintenance
2. Perform maintenance type like RFT, PM, CM, etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Hammer and Nail
- Screw and screw driver
- Pipe wrench
- Nut, bolt and washer
- Spanner
- Hack saw
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the tools.

### Say

- Tell the participants about the different tools.

## Elaborate

Tell them – There are many types of tools such as:

1. Hammer and Nail
2. Screw and Screw Driver
3. Cutting Pliers
4. Pipe Wrench
5. Nut, Bolt, and Water
6. Chain Saw
7. Mallet
8. Spanner
9. Anvil
10. Rectangular File
11. Spirit Level
12. Hack Saw
13. Measuring Tape
14. Bench Vice

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 88 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



## Activity

- Divide the class into two equal groups.
- Tell the participants they have to demonstrate the Tools.
- Assign some tools to each group.
- Tell them they would be given a time of 15 minute for preparation. The time for presentation for each group should not exceed 20 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstrate the tools	1 hour	Tools and Charts

## Unit 3.5: Hazards and Risks in Maintenance Activity

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify various hazards and risks involved in maintenance activity.
2. Act on preventing measures to avoid hazards and risks.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Hazards and Risks in maintenance activity.

### Say

- Tell the participants about the maintenance. Maintenance is conducted in all sectors and by almost all professions — it is not the exclusive domain of maintenance technicians and engineers. Hence, workers carrying out maintenance are exposed to a wide variety of hazards — chemical, physical, biological or psychosocial.

### Elaborate

Tell them – Maintenance workers are may be at risk of:

- Developing musculoskeletal disorders, through working in awkward postures, sometimes also in unfavourable environmental conditions (e.g. cold);
- Exposure to asbestos — while maintaining old buildings or industrial installations;
- Asphyxiation in confined spaces;

- Exposure to chemical agents (e.g. greases, solvents, corrosives)
- Exposure to biological hazards — hepatitis A, legionella;
- Exposure to dust, including carcinogenic wood dusts;
- Accidents (all types, including falls through or off something and being hit by a piece of machinery).

Maintenance is one of the workplace activities that can affect the health and safety not only of the workers directly involved in it, but of other workers and even members of the public, if safe work procedures are not followed and the work is not done properly. Maintenance activities can cause harm to workers and others in three main ways:

- An accident/injury may occur during maintenance
- Poor-quality maintenance
- Lack of maintenance may not only shorten the lifespan of equipment or buildings, but may also cause accidents

### Say

- Tell the participants about the Aspects to be considered. Considering the wide range of hazards and risks associated with maintenance, it may be necessary to include it in the comprehensive management system of the company. A thorough risk assessment has to be conducted, including all stages of the activity and all hazards.
- Discuss with the participants about the Structured Approach. The process of maintenance starts with the design and planning stage. Allocating sufficient time and resources for maintenance work, ensuring training and competence of the maintenance staff, putting in place safe systems of work based on an appropriate risk assessment, effective communication between production and maintenance staff are key issues.
- Tell the Participants about the System of work.

### Elaborate

Tell them – Maintenance is often performed under time pressure – to restart an interrupted production process, or to complete scheduled work before a deadline. Maintenance workers may also have to work with machinery that does not have usual safeguards in place. Therefore, a system has to be in place, based on the risk assessment, to ensure that maintenance can be carried out safely, that the workers involved in an on-going production process remain safe, and that equipment can be started up safely afterwards.

### Say

- Tell the participants about the Training. Most workers carry out some maintenance tasks. Even though workers are frequently multi-skilled and routine maintenance may be part of their job description, activities that are not performed regularly have to be included in their training. Accidents may occur if workers try to do tasks they are not trained for or experienced in.
- Tell the participants about the Procurement of Equipment's.

## Elaborate

Explain – Maintenance activities can require workers to operate in dangerous locations, as outlined above. This may involve the use of equipment that is not routinely used in the workplace, including personal protective equipment (PPE). Procurement procedures must be in place to ensure that the necessary tools and PPE (along with the necessary training and care of this equipment) are available for safe maintenance. For example, temporary lighting may need to be explosion protected, and appropriate PPE provided (e.g. respiratory protection for use when cleaning filters). During the procurement of new machinery and buildings, ease of access for performing maintenance should be considered: risks during maintenance can be minimized or even eliminated through good design of work equipment, availability of relevant tools and information from the supplier or manufacturer.

## Say

- Now tell the participants about the Maintenance of a Process. It is essential to consider maintenance as a process rather than single task.

## Elaborate

Tell them – The maintenance process starts with the planning phase, when a comprehensive risk assessment is carried out. The scope of work is decided upon and the required resources are identified (e.g. range of skills and number of workers and their roles, tools needed), as well as the hazards and precautions to be taken.

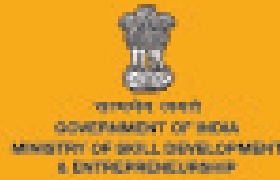
- Appropriate tools (including PPE\*) have to be made available.
- The process should be documented and records of tasks performed, as well as the sign-off condition, should be verified and approved.
- The process should be documented and records of tasks performed, as well as the sign-off condition, should be verified and approved.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



**Skill India**  
शिक्षणं मरणं - कृषणं मरणं



# 4. Assisting the Operator in Material Handling in Weighing

Unit 4.1 – Introduction to Material Handling Equipments

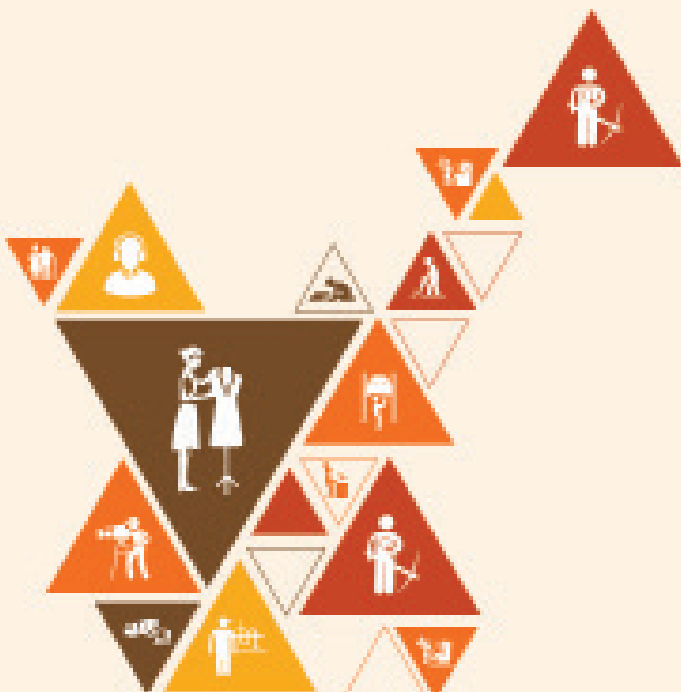
Unit 4.2 – Transport Equipments

Unit 4.3 – Positioning Equipments

Unit 4.4 – Unit Load Formation Equipments

Unit 4.5 – Storage Equipments

Unit 4.6 – Principles of Designing and Selecting Material Handling System



## Key Learning Outcomes

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

1. Identify and understand various material handling equipments used in rubber processing
2. Understand categorisation of material handling equipment
3. Identify and understand various transport equipments used in rubber processing
4. Use and understand equipment like cranes, conveyors, industrial trucks etc.
5. Identify and understand various positioning equipments used in rubber processing
6. Use and understand equipment like lift, turn table, dock leveller, ball transfer table, manipulators
7. Identify and understand various unit load equipments used in rubber processing
8. Use and understand equipment like pallets, skids, tote pans, cartons, shrink wrap etc.
9. Identify and understand various storage equipments used in rubber processing
10. Use and understand equipment like pallet rack, drive through rack etc.
11. Understand principles of designing and selecting material handling system

## UNIT 4.1: Introduction to Material Handling Equipments

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and understand various material handling equipments used in rubber processing
2. Understand categorization of material handling equipment.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Material Handling Equipments in this unit of the program.

### Say

- Tell the participants about the Material Handling. It is the set of techniques which include the art of lifting, placing, storing or moving of materials through the use of appropriate handling of equipment & men.

### Elaborate

Tell them – Material Handling Equipments are those equipments which are used for the material handling process. They encompasses a diverse range of tools, vehicles, storage units, appliances and accessories involved in transporting, storing, controlling, enumerating and protecting products at any stage of manufacturing, distribution consumption or disposal.

MHEs are basically categorized into four types. They are:

- Transport equipments
- Positioning Equipments

- Unit Load Formation equipments
- Storage equipments

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



## UNIT 4.2: Transport Equipments

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and understand various transport equipments used in rubber processing
2. Use and understand equipment like cranes, conveyors, industrial trucks etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Pallet Jack
- Conveyor
- Cranes
- Floor hand truck
- Rider Platform truck
- Side loader
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Transport Equipments in this unit of the program.

### Say

Tell the participants about the Transport Equipments. Transport equipments are equipments used to move materials from one location to another within a facility or at a site.

The major subcategories of transport equipments are:

- Conveyors
- Cranes
- Industrial Trucks
- Material can also be transported manually using no equipment.

## Elaborate

Tell them – Conveyors in Details

Conveyors are MHEs which are used:

- When material is to be moved frequently between specific points
- To move materials over a fixed path
- When there is a sufficient flow volume to justify the fixed conveyor investment

They can be classified in different ways:

- Type of product being handled: unit load or bulk load
- Location of the conveyor: overhead, on-floor, or in-floor
- Whether or not loads can accumulate on the conveyor

Some of the common types of conveyors commonly used in rubber industry are:

- Chute Conveyor
- Wheel Conveyor
- Roller Conveyor
- Gravity Roller Conveyor
- Powered Roller Conveyor
- Belt or chain driven
- Chain Conveyor
- Flat Belt Conveyor
- Troughed Belt Conveyor
- Bucket Conveyor
- Screw Conveyor

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 99 explain trainees' the concept.

## Say

Now tell the participants about the Cranes. Cranes are used to move materials over variable paths within a restricted area. The major types of cranes used in rubber industry are:

- Jib crane
- Bridge crane
- Gantry crane

## Elaborate

Tell them – General characteristics of cranes:

- Used to move loads over variable (horizontal and vertical) paths within a restricted area
- Used when there is insufficient (or intermittent) flow volume such that the use of a conveyor cannot be justified
- Provide more flexibility in movement than conveyors
- Provide less flexibility in movement than industrial trucks
- Loads handled are more varied with respect to their shape and weight than those handled by a conveyor
- Most cranes utilize hoists for vertical movement, although manipulators can be used if precise positioning of the load is required

### Jib Crane

Operates like an arm in a work area, where it can function as a manipulator for positioning tasks

### Bridge Crane

- Bridge mounted on tracks that are located on opposite walls of the facility enables three-dimensional handling

### Gantry Crane

- Single leg, double leg, and mobile types of gantry cranes

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 102 explain trainees' the concept.

## Say

- Now tell the participants about the Industrial Trucks. Industrial trucks are equipments which are used to move materials over variable paths, with no restrictions on the area covered by the movement. Industrial trucks are used to move materials over variable (horizontal) paths with no restrictions on the area covered.

## Elaborate

Tell them – Industrial Truck provide vertical movement if the truck has lifting capabilities. They are also used when there is insufficient (or intermittent) flow volume such that the use of a conveyor cannot be justified. They provide more flexibility in movement than conveyors and cranes. They are not licensed to travel on public roads – "commercial trucks" are licensed to travel on public roads.

### Characteristics of industrial trucks:

- **Pallet/Non-Pallet:** Does the truck have forks for handling pallets, or does the truck have a flat surface on which to place loads.
- **Manual/Powered:** Does the truck have manual or powered vertical (lifting) and/or horizontal (travel) movement capabilities.
- **Walk/Ride:** For non-automated trucks, can the operator ride on the truck (in either a standing or sitting position) or is the operator required to walk with the truck during travel.

- **Stack/No Stack:** Can the truck be used to lift loads for stacking purposes.
- **Narrow Aisle:** Is the lift truck designed to have a small turning radius or does it not have to turn at all in an aisle when loading/unloading.
- **Automated:** Is the truck automated so that it can transport loads without requiring an operator.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 103 explain trainees' the concept.

## Say

- Now tell the participants about the types of Industrial Trucks used in rubber industry.

## Elaborate

Tell them – The various types of Industrial Trucks used in rubber industry are:

- Hand Truck
- Pallet Jack
  - » Manual Pallet jack
  - » Powered Pallet Jack
- Walkie Stacker
  - » Manual Walkie Stacker
  - » Powered Walkie Stacker
- Pallet truck
- Platform Truck
  - » Walkie Platform truck
  - » Rider Platform truck
- Counterbalanced Lift Truck
  - » Sit-Down Counterbalanced Lift Truck
  - » Stand-up Counterbalanced Lift truck
- Side Loader
- Tractor-Trailer
- No Equipments

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 4.3: Positioning Equipments

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and understand various positioning equipments used in rubber industry
2. Use and understand equipment like lift, turn table, dock leveller, ball transfer table, manipulators.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Turn Table
- Dock Leveler
- Manipulators
- Balancer
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Positioning Equipments in this unit of the program.

### Say

- Tell the participants about the Positioning Equipments. Positioning equipments are used to handle material at a single location so that the material is in the correct position for subsequent handling, machining, transport, or storage.

## Elaborate

Tell them – Unlike transport equipments, positioning equipments are usually used for handling at a single workplace. Material can also be positioned manually using no equipment.

As compared to manual handling, the use of positioning equipment can provide the several benefits [Modern Materials Handling, Sept. 1993].

The various types of positioning equipments used in rubber & allied industries are:

- » Manual (No Equipment)
- » Lift/Tilt/Turn Table
- » Dock Leveler
- » Ball Transfer Table
- » Hoist
- » Manipulators
- » Balancer
- » Industrial Robots

## Say

- Tell the participants about the Manual (No Equipment). Material can be positioned manually using no equipment. Under ideal circumstances, maximum recommended weight for manual lifting to avoid back injuries is 51 lbs.
- Also tell the participants about the Lift/Tilt/Turn Table.

## Elaborate

Tell them – Lift/Tilt/Turn table are used when positioning involves the lifting, tilting, or turning of a load. They can be used to reduce or limit a worker's lifting and/ or reaching motions.

Pallet load levelers are lift and turn tables used in manual palletizing to reduce the amount of bending and stooping involved with manually loading a pallet by combining a lifting and turning mechanism with a device that lowers the table as each layer is completed so that loading always takes place at the optimal height of 30 inches.

## Say

- Tell the participants about the Dock Leveler. They are used at loading docks to compensate for height differences between a truck bed and the dock. They are commonly used in raw material reception and finished goods dispatch areas.
- Discuss with the participants about the Ball transfer table. They are used in conveyor systems to permit manual transfer to and from machines and conveyors and between different sections of conveyors. Since loads are pushed on the table, ball friction limits the maximum load weight to 600 lbs.
- Also tell the participants about the Hoist and manipulators.

## Elaborate

Tell them – Hoists are used for vertical translation (i.e., lifting and lowering) of loads. They are frequently attached to cranes and monorails to provide vertical translation capability. They can be operated manually, electrically, or pneumatically.

- Manipulators are MHEs used for vertical and horizontal translation and rotation of loads. Acting as "muscle multipliers," manipulators counterbalance the weight of a load so that an operator lifts a small portion (1%) of the load's weight. They can be powered manually, electrically, or pneumatically.

## Say

- Tell the participants about the Balancer. Balancers are mechanisms used to support and control loads so that an operator need only guide a balanced ("weightless") load, thus providing precision positioning. They can also be attached to hoists and manipulators.
- Also tell the participants about the Industrial Robots.

## Elaborate

Tell them – Industrial Robots are used in positioning to provide variable programmed motions of loads. "Intelligent" industrial robots utilize sensory information for complex control actions, as opposed to simple repetitive "pick-and-place" motions.

Industrial robots also used for parts fabrication, inspection, and assembly tasks. They consist of a chain of several rigid links connected in series by revolute or prismatic joints with one end of the chain attached to a supporting base and the other end free and equipped with an end-effector.



## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 4.4: Unit Load Formation Equipments

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and understand various unit load equipments used in rubber processing.
2. Use and understand equipment like pallets, skids, tote pans, cartons, shrink wrap etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Pallets
- Skids and slip sheets
- Cartons
- Containers
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Unit Load Formation Equipments in this unit of the program.

### Say

- Tell the participants about the Unit Load Formation Equipments. Unit load formation equipments are used to restrict materials so that they maintain their integrity when handled a single load during transport and for storage. Some of the advantages of unit load equipments include the ability to handle more items at the same time, thereby reducing the number of trips required and, potentially, reducing handling costs, loading and unloading times, and product damage.

## Elaborate

Explain – Some of the commonly used Unit Load equipments in rubber and allied industry are:

- Self-Restraining (No Equipment)
- Pallets
- Skids
- Slip sheets
- Tote Pans
- Pallet Boxes/Skid Boxes
- Bins/Baskets/Racks
- Cartons
- Bags
- Bulk Load Containers
- Crates
- Intermodal Containers
- Strapping/Tape/Glue

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 112 explain trainees' the concept.

## Say

- Tell the participants about the Shrink-Wrap/Stretch-Wrap. Shrink-Wrap/Stretch-Wrap are also used for load stabilization.

## Elaborate

Tell them – In **shrink-wrapping**, a film or bag is placed over the load and then heat is applied to shrink the film or bag; allows irregular loads to be stabilized; manual or automatic; most shrink-wrap applications are being replaced by stretch-wrapping.

In **stretch-wrapping**, a film is wound around the load while the film is stretched; allows irregular loads to be stabilized; manual or automatic; as compared to shrink-wrapping, stretch-wrapping has lower material, labor, and energy costs.

## Say

- Tell the participants about the Palletizers. Palletizers are used for load formation.

## Elaborate

Explain – Three general methods of building (or "palletizing") unit loads:

1. Manual Palletizing
2. Robotic Pick and Place Palletizers

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 4.5: Unit Load Formation Equipments

### Unit Objectives

At the end of the unit, students will be able to:

1. Identify and understand various storage equipments used in rubber processing.
2. Use and understand equipment like pallet rack, drive through rack etc.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Racks
- Shelves/Bins/Drawers
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Storage Equipments in this unit of the program.

### Say

- Tell the participants about the Storage Equipments. Storage equipments used for holding or buffering materials over a period of time. The most common reason for storing a product allows the other elements of production to operate more efficiently on a per-unit basis because the fixed costs associated with utilizing the element can be spread over more products

## Elaborate

Tell them – Other potential reasons for storage include: time bridging—allows product to be available when it is needed (e.g., storing spare machine parts at the facility); processing—for some products (e.g., mixed compound), storage can be considered as a processing operation because the product undergoes a required change during storage; and securing.

The major types of storage equipments are:

1. Block Stacking (No Equipment)
2. Selective Pallet Rack

Selective racks can be used for the following types of storage:

- **Standard:** Single-deep storage using a counterbalanced lift truck.;
  - **Narrow-Aisle:** Storage using a narrow-aisle lifts truck;
  - **Deep-Reach:** Greater than single-deep storage (typically double-deep storage).
3. Drive-Through Rack
    - Flow-Through Rack
    - Sliding Rack
    - Shelves/Bins/Drawers
    - Storage Carousel
    - Automatic Storage/Retrieval Systems (AS/RS)

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Pahe No 117 - 119 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

- Divide the class into four equal groups.
- Tell the participants they have to demonstrate the Principles of Designing and Selecting Material handling System.
- Tell them they would be given a time of 20 minute for preparation. The time for presentation for each group should not exceed 20 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstrate the Principles of Designing and Selecting Material handling System	2 hour	Charts and markers

## UNIT 4.6: Principles of Designing and Selecting Material Handling System

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand principles of designing and selecting material handling system.

### Resources to be used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Principles of Designing and Selecting Material Handling System in this unit of the program.

### Say

- Tell the participants about the Principles of Designing and Selecting Material Handling System. According to the Material Handling Institute, there are 20 principles for designing and selection of a material handling equipment. These principles have to be taken care of irrespective of whether the industry is related to rubber or not.



## Elaborate

Tell them – The Principles of Designing and Selecting Material Handling System are:

<b>Orientation Principle</b>	Study the system relationships thoroughly prior to preliminary planning in order to identify existing methods and problems, and physical and economic constraints, and to establish future requirements and goals.
<b>Flexibility Principle</b>	Use methods and equipment which can perform a variety of tasks under a variety of operating conditions.
<b>Planning Principle</b>	Establish a plan to include basic requirements, desirable options, and the consideration of contingencies for all material handling and storage activities.
<b>Simplification Principle</b>	Simplify handling by eliminating, reducing, or combining unnecessary movements and/or equipment.
<b>Systems Principle</b>	Integrate those handling and storage which are economically viable into a coordinated system of operation including receiving, storage, production, assembly, packaging, warehousing, shipping, and transportation.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 121 explain trainees' the concept.

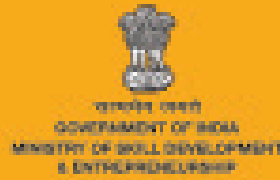
## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.





**Skill India**  
शिक्षणं मरणं - कृषणं मरणं



# 5. Introduction to Manufacturing Processes

Unit 5.1 – Standard Operating Procedures

Unit 5.2 – Weighing of Ingredients

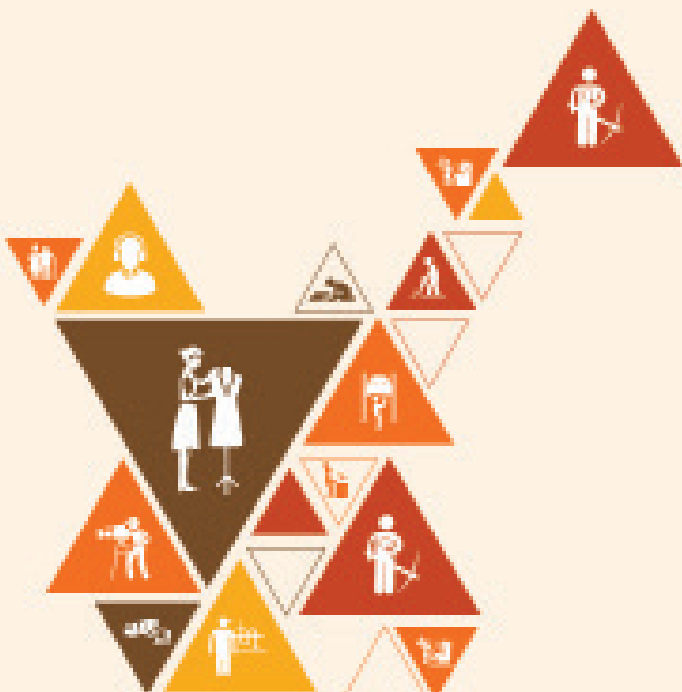
Unit 5.3 – Mastication, Master Batching and Final Mixing

Unit 5.4 – Extrusion and Calendering

Unit 5.5 – Compression and Transfer Moulding

Unit 5.6 – Injection and Miscellaneous Moulding Techniques and Moulding Equipments

Unit 5.7 – Post–Moulding Operations and Defects in Moulded goods



## Key Learning Outcomes

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

1. Understand the standard operating procedures (SOPs) and their types.
2. Prepare SOPs.
3. Understand the product life cycle.
4. Understand the mastication, master batching and final mixing.
5. Different methods of mastication
6. Understand the advantages and disadvantages of final mixing
7. Weigh the ingredients accurately
8. Understand the sequence of weighing
9. Store and identify the weighed materials
10. Familiarize extrusion and calendaring
11. Understand various types of extrusions and calendaring
12. Familiarize with moulding and its types
13. Understand compression moulding and transfer moulding
14. Understand and familiarize injection moulding and miscellaneous moulding
15. Use moulding press and mould design
16. Understand post moulding operations
17. Identify defects in moulded products
18. Use moulding press and understand mould design

## UNIT 5.1: Standard Operating Procedures

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand the standard operating procedure (SOPs) and their types.
2. Prepare SOPs.
3. Understand the product life cycle.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Standard Operating Procedure in this unit of the program.

### Say

- Give the participants a brief introduction about the unit. Every product is born out of a need and has to go through the process of “Industrialization” before it reaches the final customer. Like human beings, a product also has a “life cycle” – it is born, it grows, matures, and perishes at last. To extend the life cycle, the product has to have a good manufacturing process support.

## Elaborate

Tell them – One of the key elements of consistent quality is ‘SOP’ which is to be followed like a scripture by the operator. Different types of SOPs are available according to the process in hand.

### How a product is born?

“A product is a set of benefits offered for exchange and can be tangible or intangible”.

There are several process involved in the development of a product:

- Idea generation- based on voice of customer
- Product design –to suit the specified and implied needs of the customer
- Robust process design..
- Market research and analysis, sales and after sales service.

This is in general the process by which a product is born and marketed.

### The product life cycle – a bird’s eye view

Like every living being, a product also has to undergo different ups and downs in its life span. This process is popularly known as product life cycle (PLC).

There are generally four stages in the life of a product:

- Introduction stage
- Growth stage
- Maturity stage
- Decline stage

### Good Manufacturing Practice (GMP)

Any successful organization, whether it is a service sector or manufacturing sector, should have good manufacturing practice prevailing in their process.

A brief list of some of them is given below:

- A well-defined manufacturing process with proper linkages
- Clear and un- ambiguous instructions and procedures
- Operators are trained on SOP with a focus on quality and safety
- Monitoring and documenting of process.
- All deviations are investigated and corrective and preventive actions taken
- Validation of critical processes using statistical techniques
- Management and control of changes in manufacturing process.
- Very good system of identification and traceability.
- All customer complaints are redressed in stipulated time., etc.

## Say

- Tell the participants about the Standard Operating Procedure. A standard Operating procedure (SOP) is a document which describes in simple terms, the activities to be carried out for a routine operation with reference to safety of the operator and machine and quality of the process and product.
- Also tell the participants about the types of SOP.

## Elaborate

Tell them – The term ‘SOP’ is more generic in nature in the industrial parlance. An ‘SOP’ can include work instructions, “Dos” and “Don’ts” safety instructions, and even specifications.

To name a few ‘SOP’, from a manufacturing scenario

- SOP for safety precautions
- SOP for loading of rubber compound on to mill
- SOP for stacking of materials in RMS(Raw material storage)
- SOP for warming up of press
- SOP for quality inspection
- SOP for identification and traceability etc.

## Say

- Tell the participants about the preparation of SOP. An ‘SOP’ is a very important document and it should be prepared with utmost care and diligence. An ‘SOP’ has to be prepared by a team of process experts. It should be comprehensible to all and subject to changes as and when required. It shall be short and precise.
- Discuss with the participants that SOP is a Tool and not a Goal. An ‘SOP’ is one of the tools to achieve consistency in process and product quality.
- Also tell participants an example of SOP.

## Elaborate

1. Obtain the specification of the tea or understand the customer requirement (Quantity, Black or white, light or strong, with or without sugar, etc)
2. Organise the resources (Burner, Vessels, Utensils, Raw materials etc.)
3. Proceed to make the tea following the SOP

**SOP for making tea**

(Given that the tea has to be black, light and without sugar referring to need as stated by the guest)

- Wear the Kitchen apron and fasten it firm on to your body.
- Clean the vessel and take the required amount of water inside it.
- Light the burner using the lighter and keep the vessel on it.
- Cover the vessel with its lid.
- Wait for the music of the kettle to be heard
- Open the vessel and wait for the water to fully boil. Please ensure Hand gloves, are in good condition and you are wearing them while handling the hot lid.
- When the water boils, add the specified amount of tea dust (as specified for a light tea)
- Close the vessel with the lid immediately
- Continue boiling for another half a minute
- Put off the flame and allow the tea dust to settle for three minutes.
- Carefully, using a filter placed on the cup, pour the tea decoction into the cup without spillage.
- Inspect the tea cup for any spillage and if found with tea decoction on the outside, clean it using a clean wipe.
- Arrange the filled tea cups in the serving tray, also placing the saucer below the cup, and serve.

While this SOP itself can be more detailed and elaborate and also including more activities such as keeping back the vessels and materials, cleaning the cooking pot, the principle of making a SOP may be noted – The emphasis is on the breaking up of the bulk activity of “Make two cups of tea” to as many sub activities as possible and detailing the way these sub activities are carried out, so that the variability in the end product every time it is prepared, is minimised.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



## UNIT 5.2: Weighing of Ingredients

### Unit Objectives

At the end of the unit, students will be able to:

1. Weigh the ingredients accurately
2. Understand the sequence of weighing
3. Store and identify the weighed materials

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Weighing of Ingredients in this unit of the program.

### Say

Tell the participants about the Weighing of Ingredients. The accurate weighing of ingredients is essential for the quality of the compound and also for the expected performance of the finished product. It is a critical process from the point of view of the cost of the materials also, which cannot be wasted.

## Elaborate

- Tell them – There are many aspects of compounding such as the sequence of weighing, the tolerances to which the chemicals are weighed, the calibration of balances and many more... This session gives a total picture about the such aspects and tunes the mind of the participant to view the process of chemical weighing as one of extreme importance.
- Compound quality is believed to be one of the core parameters of product quality and the weighing of ingredients is the most important factor affecting compound quality. Ingredients of a rubber mix are also extremely costly ingredients to waste. Further, any wrong chemical weighing will result in a compound that may have to be scrapped which is all the more costly.

## Say

- Tell the participants about the Sequencing of Weighing. Generally, chemical weighments are done by categorizing the total formula ingredients into the number of stages that has been fixed for mixing any compound.

## Elaborate

Explain – Typically, in the rubber mixing process, for the fear of the resultant temperature, the mixing is divided into Master Batch and Final Batch. In some of the compounds, there are additional stages designed for;

- Improvement of uniformity, dispersion etc.
- Addition of special purpose ingredients and
- Deliberate breakdown and reduction of viscosity

## Say

- Tell the participants about the Weighing of Chemicals for Master Batch. Typically, all the ingredients, except Sulphur, Accelerators and Retarders can be added in a single step in Master Batch mixing. In chemical compounding for Banburys the ingredients are all weighed into a polythene packet one over the other.
- Also tell the participants about the Weighing of Chemicals for Final Batch. The weighing of chemicals for final batch is much more critical than that of master batches since the final batch chemicals affect the properties of the compound in a much more significant manner, i.e., the Master Batch ingredients allow a greater freedom of tolerances and , the Final Batch ingredients weighed to the same tolerances critically affect the compound's output characteristics. Therefore, the weighing of Final Batch chemicals is done generally with balances having greater precisions and accuracy.
- Tell the participant about the Weighing Tolerances.

**Elaborate** 

Tell them – The tolerance to which the chemicals are to be weighed is an important parameter of chemical weighing. These tolerances as we have seen now are of varying criticality in master batch and final batch. The tolerances are also dependent to the weight of the batch of which the ingredients form a part of. While it is acceptable to have larger tolerances for the larger batch weights (for e.g. F-660, F-440, etc., Banbury sizes) it is weighed to narrow tolerances for lower size Banburys and also for smaller Intermixes.

The accuracy of the balances shall follow the common principle of having least count to the tune of 1/10th of the allowable tolerance.

**Say** 

Tell the participants about the Automation in Weighing.

**Elaborate** 

Tell them – All along, the practice in the rubber industry was to weigh the chemicals by hand one over the other, checking the cumulative weights of ingredients added one after the other. This is a very vulnerable process as far as the accuracy of the weighing is concerned. Also is very labour intensive.

**Do** 

- Discuss with participants about the Calibration of Balances. In any method of chemical weighing, the calibration and maintenance of the accuracy of balance is of utmost important as far as the weighing quality is concerned. Factories have their own internal schedule of calibration of balances and they have fully equipped calibration laboratories inside the factories. However for small scale units, where such facilities are not set up, external help in the form of certified calibration agencies are available.

**Say** 

- Tell the participants about the Storage and Identification of Weighed Materials. The weighed ingredients are to be used up at the earliest. Exposure of chemicals out of their basic or parent packaging, makes them susceptible to attack to moisture, dust, etc. Therefore, it is important that the weighed chemical packets are kept fully closed while in storage and in transit from the chemical area to the machine proper.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 5.3: Mastication, Master Batching and Final Mixing

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand the mastication, master batching and final mixing.
2. Different modes of mastication.
3. Understand the advantages and disadvantages of final mixing.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Rolls.
- Internal Mixer.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Tell the participants about the Mastication. Processing is a general term which includes all the operations which are carried out on the rubber and which alter its physical shape and chemical structure.

## Elaborate

Tell them – Mastication is a preliminary stage to processing the raw rubber. During mastication the viscosity of rubber is reduced by break down either mechanically or by heat or by use of chemical peptizers. This improves the plasticity and reduces the viscosity. The increase of plasticity or decrease of viscosity brought about by peptisers is permanent; by heat it may be permanent or temporary, depending on the nature of the polymer. In its raw form, NR is a very high molecular weight (MW). Molecular weight of NR can't be controlled as it is always the case for synthetic rubbers. High MW means high viscosity thus renders it hard. It is almost impossible to mix any powder or liquid ingredients into NR at its original viscosity.

Thus Natural rubber requires controlled reduction in molecular weight; this molecular weight reduction process is called mastication process.

With the availability of constant viscosity and low viscosity natural rubber and of synthetic rubbers of suitable viscosity for direct mixing, the need for mastication may well be eliminated in due course.

1. Mastication without peptizers
2. Mechanical mastication
3. Oxidative mastication
4. Mastication with peptizers
5. Mastication on open mill
6. Mastication in internal mixtures

The NR mixed in the internal mixer is cooled down to 800 C on a follow-up machine and formed on a calendar, extruder, strainer, or pelletizer, powdered or treated with anti-tack media.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 134 explain trainees' the concept.

## Say

- Tell the participants about the Compounding Stages. Depending on the composition and processing requirements compound mixing is done in different stages namely:
  - » Master batch mixing
  - » Re pass stage mixing
  - » Final mixing

## Elaborate

- Tell them – The different stages of compounding are as follows:
  1. Master batch mixing: At master batch mixing stage the rubber is intimately mixed with the additives that are necessary in order to provide good service properties. The additives added at this stage includes highly active and other fillers, plasticizers, processing aids, anti-oxidants, ozone protectors, pigments, etc. These are dispersed as rapidly and as effectively as possible.

2. Re pass stage mixing: In re pass stage master batch is further remixed to improve dispersion of the compound and compound viscosity is reduced according to the requirements of the subsequent operation.
3. Final compound mixing: In this stage, the materials that are necessary for curing and bonding to substrates, like sulphur, accelerator, retarder etc. are added at a temperature that is lower than the master batch temperature.

**Advantages**

- Master batches can be mixed at higher speed and temperature.
- Less total mixing time than one pass method
- Master batching improves the physical properties of those compounds where a high degree of carbon black dispersion would be achieved.

**Disadvantages**

- Two stages entails expensive transportation within the plant area
- Increases the occurrence of unusable residual quantities.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 136 explain trainees' the concept.

## UNIT 5.4: Extrusion and Calendering

### Unit Objectives

At the end of the unit, students will be able to:

1. Familiarize with extrusion and Calendering
2. Understand various types of extrusions and calendering.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Rubber Wiper Sponge
- Rubber Cord
- Rubber Bushes
- Rubber tubes
- Rubber
- Rubber products
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Extrusion and Calendering in this unit of the program.

### Say

- Tell the participants about the Extrusion Process. Extrusion is a process used to create objects of a fixed, cross-sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main advantages of this process over other manufacturing processes are its ability to create very complex



cross-sections and work materials that are brittle, because the material only encounters compressive and shear stresses.

- Also tell the participants about the Rubber Extrusion Process. Generally screw extruders are used for extrusion of rubbers [recollect the parts of extruders that you have studied in the previous module]. The length to diameter ratio of the extruder barrel is in the range of 10 to 15, to reduce the risk of premature cross-linking

## Elaborate

Explain – The Rubber extrusion is performed through the following steps:

- It begins with the feeding of unvulcanized rubber compound into the extruder.
- The revolving screw carries the rubber forward into the die with an increase in pressure and temperature
- The material gets closer to the die itself
- The built up pressure forces push the material through the openings
- The rubber product is formed in the shape of die
- The product formed is then vulcanized

As you know the extrusion die is a precise and specific tool made by cutting an opening shaped in the form of the finished rubber cross section desired through a blank of steel. Once in place, the rubber material will be forced through this die via the pressure that builds up from the revolving screw of the extruder.

Now a day's Large number of extruded products are available. Some of them are listed below

1. **Rubber wiper for proper cleaning:** These wipers are made out of force rubber, which refills the long metal handles and facilitates easy removal of water. Mainly Natural Rubber and Neoprene rubber are used
2. **Rubber cord:** Generally it is a strip of rubber used along the edges of glasses to provide them support for withstanding jerks and shocks. Usually used rubbers are Natural rubber, EPDM, Neoprene, Nitrile rubber and silicon rubber.
3. **Rubber Bushes:** Fabricated using fine grade rubber moulds
4. **Transparent Rubber Tubes:** Having very high flexibility, elasticity and can be easily stretched & compressed. Usually prepared with silicon rubber
5. **Extruded rubber sponge:** Widely used in high and low temperature acoustic insulation, thermal insulation and high and low temperature gasket and seal; mainly silicon rubbers are used.

## Say

- Tell the participants about the Calendaring. Calendaring is a process used to manufacture sheet or film products. Rubber calendaring is mainly used for making close tolerance rubber sheeting's, rubberized cloths, and elastomeric films etc. Here the rubber material is passed through a series of rollers to flatten, and joint together two or more materials.

## Elaborate

Tell them – Sheetings produced through the calendering process is divided into two

1. Fabric inserted
2. Unsupported

Fabric inserted calendering

Unsupported calendering

In unsupported calendering process only layers of rubber that have been joined without cord, cloth or textile being inserted for strength or tear resistance.

Rubbers that can be used for making calendered products include: Natural rubber, Styrene butadiene rubber, EPDM, Nitrile, Neoprene, Hypalon and Viton

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- wAnswer their queries satisfactorily.

## UNIT 5.5: Compression and Transfer Moulding

### Unit Objectives

At the end of the unit, students will be able to:

1. Familiarize with Moulding and its types
2. Understand compression moulding and transfer moulding

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Compression Mold
- Transfer Mold
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Tell the participants about the Moulding. Moulding is the simplest process of making a product from rubber compound. In this process an unvulcanised rubber compound is converted from a relatively plastic to an elastic state, making the shape of the moulded piece permanent.

## Elaborate

Tell them – The moulding process involves in the application of heat and pressure simultaneously to an unvulcanised rubber compound placed in a mould.

There are several types of Moulding:

1. Compression
2. Transfer
3. Injection
  - » Miscellaneous Blow moulding
  - » Wrapped mandrel moulding
  - » Vacuum moulding

## Say

- Tell the participants about the Compression Moulding.

## Elaborate

- Tell them – Different types based on the design of the mould;
  - » Straight or flash type
  - » Positive or plunger type
  - » Semi-positive

Choice of the type depends on the type of product being made and its quality and cost considerations.

Straight or flash type of compression moulds

- Loaded by placing an excess volume of the mix directly in the cavity followed by closing of the mould and application of pressure and heat.

The advantages of this type mould include :

- » Simple design
- » Easy fabrication
- » Least expensive
- » Better heat transfer than other types of compression moulds and
- » Suitability for products of relatively simple shapes

But there are certain disadvantages as well:

- » It is not suitable for extremely hard and soft mixes.
- » Also pre-shaping of the mix is needed for products of complicated shapes.

- » Non-uniform state of cure for thick articles and
- » Poor rubber-to-metal bonding in the case of composite products.

#### **Positive or plunger type of compression mould**

A plunger is provided to the lid whose diameter is just as that of the cavity. This design ensures application of the full press load directly on the rubber mix and hence is suitable for moulding of extremely soft and hard mixes.

Positive compression moulds are more expensive to make and to maintain. As the clearance between the plunger and the cavity walls is very narrow, it is likely that during moulding, even a slight misalignment of the two halves may cause damage to the plunger as well as the cavity and hence frequent repair of the mould becomes necessary.

#### **Semi-positive type**

This is a compromise between the positive and straight types. A plunger in the lid ensures application of high pressure on the mix.

### **Say**

- Tell the participants about the Transfer Moulding. Transfer Moulding involves transfer of the uncured mix from one place to another within the mould.

### **Elaborate**

- Tell them – Instead of placing the stock directly in the cavity, the mould is closed with the cavities empty. The stock is placed in the pot fitted with a ram inserted over the stock.

#### **The main advantages of transfer moulding includes:**

- Easy to mould complex shapes
- Metal-rubber bonded products are easily moulded ensuring good bonding
- No pre-shaping for complex shapes
- Volume of stock need not accurately be weighed
- Minimum de-flashing
- Shorter curing cycles and uniform state of cure
- Absence of grain effect
- Minimum air trapping

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- wAnswer their queries satisfactorily.

## UNIT 5.6: Injection & Miscellaneous Moulding Techniques & Moulding Equipment

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand and familiarize with injection moulding and miscellaneous moulding.
2. Use moulding press and mould design.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Injection Moulding
- Blow Moulding
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Give participants a brief introduction about the unit. Injection moulding was introduced to the rubber industry only a few decades ago, but has become very popular in the manufacture of certain moulded goods. While compression moulding has been popularly used in the manufacture of a large variety of rubber products, there are certain shortcomings for the technique, which lead to the development of transfer moulding.
- Now tell the participants about the Injection Moulding.

## Elaborate

Tell them – This technique has been used in the rubber industry during the last few decades, although injection moulding has been practiced in plastics for a very long time. The technique involves injecting a definite volume of rubber compound into a heated mould, kept closed under high pressure. The rubber flows, under pressure and heat, into the different cavities of the mould in a relatively short period of time. The pressure and temperature are maintained for a definite period of time to ensure curing of the rubber, when the mould is opened and the product taken out.

The rubber compound is introduced into the barrel, through the hopper. As the screw rotates, the Compound is pushed forward and develops high pressure towards the front end of the barrel, as the space inside the barrel gets reduced.

Also, stripping of the cured product is easier and there is no flash, other than the narrow strip remaining at the gate of the mould, which can be easily removed. The technique is most suitable for the production of small items which are required in large volumes.

Also rubber metal composites can be produced more efficiently as the bonding between rubber and the metal piece is much stronger. All the advantages of transfer moulding are applicable for this technique.

## Say

- Tell the participants about the Miscellaneous Moulding techniques. These techniques are reserve for certain items of rubber products, which cannot be made by the other methods.

## Elaborate

Tell them – Miscellaneous Moulding Techniques are outline below:

- **Blow Moulding:** This technique is used for the production of hollow articles such as children’s play ball, tennis ball, horn bulb etc. The technique is explained through the production of play balls.
- **Wrapped mandrel moulding:** Custom rubber mandrel wrapping is a process by which uncured rubber is wrapped on a tube ( pipe mandrel ) or directly onto the finished part and cured so it can be machined to the desired shape.
- **Autoclave curing:** Curing of products fabricated by wrapped mandrel process, such as hoses, rubber covered rollers etc. is done in an autoclave or vulcanizer.
- **Vacuum moulding:**
  - » Flat sheet like products with shallow profiles are moulded by this technique
  - » Calendered sheets, cut to size, are placed against profiled aluminium form
  - » Several such assemblies are placed together
  - » Vacuum is applied through a channel attached to the periphery of the forms
  - » With suction still applied, the assemblies are cured in large vulcanisers
  - » Relatively cost effective and energy efficient method of moulding
  - » Applicable only for products such as automotive mats with shallow profiles



## Say

- Tell the participants about the Moulding Press. The purpose of the press is to apply heat and pressure simultaneously on the mould. Heat is transferred from the hot platen of the press to the mould surface.

## Elaborate

- Tell them – The salient aspects of mould design are the following.
  - » Type of moulding – compression, transfer or injection
  - » Material of the mould – shall be strong enough to withstand pressures from 40 to 700 kg/cm<sup>2</sup> - Mild steel preferred. Number of pieces of mould – the more complex the shape, the more the number of pieces
  - » Location of parting line
  - » Number of cavities
  - » Provision for guide pins
  - » Flash grooves – location, width etc.
  - » Provision for positioning metal inserts
  - » Provision for shrinkage
  - » Transfer moulds require more skill and experience in design than compression moulds

Surface finish: Good finish for the mould surface is essential for achieving a satisfactory finish for the product.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- wAnswer their queries satisfactorily.

## UNIT 5.7: Post-Moulding Operations & Defects in Moulded Goods

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand post moulding operations.
2. Identify defects in moulded products.
3. Understand and use moulding press and mould design.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Injection Moulding
- Blow Moulding
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Give participants a brief introduction about the unit. In the two previous sessions different moulding techniques and the machines and tools employed for this were introduced. In the present session, the participants will be told how actually the process is carried out with details on each step. Also the different post-moulding operations such as de-flashing, post-curing and after-treatments will be covered. Common defects seen in moulded rubber goods will be introduced and methods to avoid such defects reviewed.
- Now tell the participants about the Moulding Process.

## Elaborate

The different steps to be followed in the process of rubber moulding are outline below.

1. Preparation of the compound for moulding
2. Pre-heating of mould
3. Mould release agents and their application
4. Mould loading and pressing
5. Curing or vulcanisation

Optimum cure time is the one that produces the best balance of properties and is usually determined using a curemeter.

The actual time of cure employed in an actual moulding operation is likely to vary from those established in a lab. The following factors must be considered when using lab data as a guide.

- Differences in thickness
- Differences in mould temp. and
- Differences due to rate of cooling of vulcanisate.

6. Stripping

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 154 - 155 explain trainees' the concept.

## Say

- Tell the participants about the Post-Moulding Operations. The moulding requires finishing processes before the product is accepted for sale.

## Elaborate

Tell them – The post-moulding operations are as follows:

- **De-flashing:** The thin film of rubber surrounding the product on the mould parting line is called flash and has to be removed. This is done manually using scissors or knives or by using punch press operated dies.

Cryogenic high speed shot blast de-flashing is a process used by the rubber industry to remove flash from moulded rubber parts.

Parts that have thin flash can be quickly and thoroughly cryogenically de-flashed.

- **Post-curing:** Post-moulding curing is practiced in the case of mouldings with incomplete cure. A well-known case is microcellular products like soling sheets. These are cured only partially to ensure expansion on mould opening.
- **Surface treatments:** Special surface treatments are applied to some moulded rubber products to enhance their appearance, improve resistance to deterioration or to reduce surface tack.

- **Halogenation:** Treatment with halogens, like chlorine, bromine etc. reduces surface tack and friction and provides a silky flexible surface layer which remains clean during service. Chlorination is the most popular halogenations method.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No.156 explain trainees' the concept.

## Say

- Tell the participants about the Defects in Moulded Products

## Elaborate

Tell them – The most common defects observed in moulded goods and their possible causes and prevention methods are discussed below.

- **Shrinkage:** Shrinkage results from the differences in the coefficients of thermal expansion of rubber and metals.
- **Air marking:** These are broad, shallow depressions on the surface of mouldings, best seen by observing at an acute angle.
- **Sponging and porosity:** Air trapped or dissolved in the mix expands an uncured stock to form voids in the moulding when the pressure is released.
- **Blisters and blow holes:** This is due to large mechanically trapped air pockets seen even in fully cured mouldings.
- **Poor knitting or flow cracks:** Lamination, visible folds, cracks or lines in a moulding are evidence of poor knitting (flowing together of stock into a single mass).
- **Backrinding:** Results from expansion of the vulcanisate when the mould is opened and is observed as rupture at the parting line. During moulding the stock remains in the cavity under compression.
- **Tearing on stripping:** This problem can be minimised by proper mould design by proper location of parting line, the use of rounded corners and thick enough sections in critical zones. Dirty or poorly lubricated moulds cause sticking.
- **Blooming:** Appearance on the surface of either a cured or uncured rubber compound of one or more of the compounding ingredients or reaction products thereof is called bloom. This is caused by migration of compounding ingredients which remains beyond their solubility limits in rubber.
- **Pebbling:** This is applied to leather-like surface condition observed when a vulcanisate is under slight strain. It occurs on gum or lightly filled vulcanisates and results from inadequate dispersion of one more of the curing ingredients. This causes nodes in the rubber having higher modulus than the surrounding matrix. These nodes are raised when the surface is stretched, giving the appearance of a leather surface. This is eliminated by ensuring proper mixing conditions or by using such ingredients in the form of master batches.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 157 - 158 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

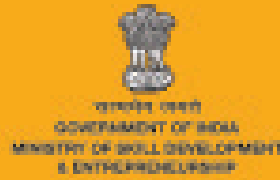
- Divide the class into two equal groups and name them Group A and Group B.
- Now assign Group A and B the topics like Post-Moulding operations and Defects in Moulded Products.
- Tell the participants they have to give a presentation on their respective topics.
- Tell them they would be given a time of 30 minute for preparation. The time for presentation for each group should not exceed 30 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights

Skill Practice	Time	Resources
1. Explain about Post-moulding operations and defects in Moulded products.	3 hour	Charts and markers





**Skill India**  
शिक्षणं मरणं - कृषणं मरणं

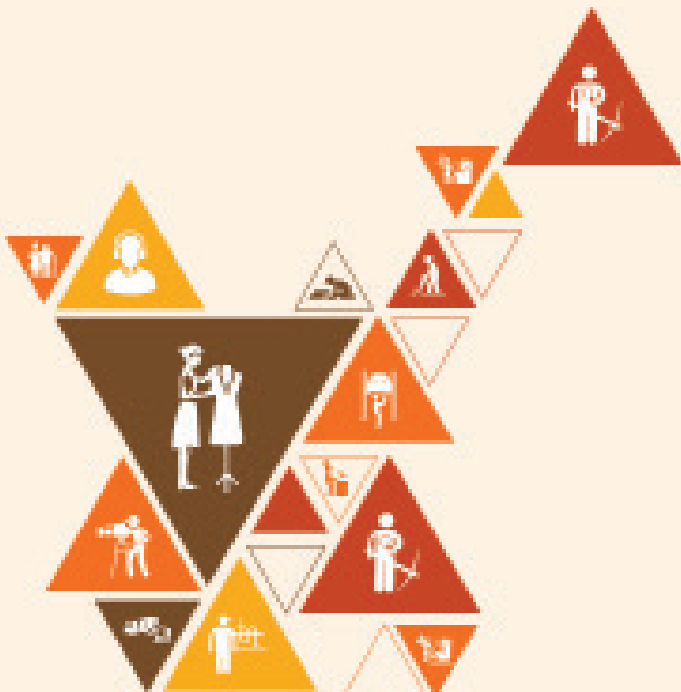


# 6. Testing of Rubbers, Rubber Compounds and Products.

Unit 6.1 – Testing of Rubbers

Unit 6.2 – Testing of Rubber Compounds

Unit 6.3 – Testing of Rubber Products



RSC/N3103

## Key Learning Outcomes

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

1. Understanding the testing of rubber and blend of rubbers.
2. Know the test methods of ISNR as per the specification (IS: 4588-1986)
3. Identify the chemical tests for synthetic rubbers
4. Prepare sample
5. Identify rubber compounds
6. Perform tests like specific gravity, viscosity
7. Perform physical testing of rubber products
8. Undertake rubber product tests like hardness test, tensile strain/stress test, tear test, abrasion test, flex cracking test, heat build-up test, rebound resilience test
9. Identify electric and temperature properties of rubber products



## UNIT 6.1: Testing of Rubber

### Unit Objectives

At the end of the unit, students will be able to:

1. Understanding the testing of rubber and blend of rubbers
2. Know the test methods of ISNR as per the specification (IS: 4588-1986)
3. Identify the chemical tests for synthetic rubbers

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Give the participants a brief introduction about the unit. Rubber product manufacturing requires lot of ingredients and these materials are supplied from various sources. Product variation in rubber industry is due to the non-uniformity of received raw rubber and other raw materials. Maintenance of quality is very important in order to achieve consistency in the final product.

## Elaborate

Tell them – Rubber product manufacturers have to rely on the vendor for total quality assurance of the raw materials that are purchased.

## Say

- Tell the participants about the Rubbers. Rubber or blend of rubbers is one of the major raw materials used for a rubber product. Natural as well as synthetic rubbers are tested for different parameters particular to the respective one.

## Elaborate

Tell them – Various tests such as burning test, acid test, color tests, pyrolysis tests and spot tests are available to identify the rubbers. Raw gum elastomers are generally tested for Mooney viscosity. This is detailed in the session of testing of rubber compounds.

Rubber or blend of rubbers is one of the major raw materials used for a rubber product. Natural as well as synthetic rubbers are tested for different parameters particular to the respective one.

Various tests such as burning test, acid test, colour tests, pyrolysis tests and spot tests are available to identify the rubbers. Raw gum elastomers are generally tested for Mooney viscosity. This is detailed in the session of testing of rubber compounds.

The ISNR specifications include dirt content, volatile matter, ash, copper, manganese and nitrogen etc. These properties are important for the processing and the life of finished goods made from natural rubber.

Test methods of ISNR as per the specification (IS: 4588-1986) are briefly described:

1. Dirt content  
Rubber hydrocarbon is dissolved in petroleum solvent and filtered through a 325 mesh sieve.
2. Volatile matter
3. Nitrogen content
4. Plasticity and viscosity
5. Accelerated Storage Hardening Test (ASHT)

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 163 - 164 explain trainees' the concept.

## Say

Tell the participants about the Chemical tests for Synthetic Rubbers. Chemical tests for synthetic rubbers include:

- Total Extractable.
- Organic Acids & Soap
- Oil

## Elaborate

Explain – Chemical tests for synthetic rubbers includes:

- **Total Extractable:** To measure any of the three constituents, it is necessary to first extract the polymer to separate the rubber from the additives.
- **Organic acid and soap:** Residual organic acid will change the cure rate of a compound.
- **Oil:** Oil is added to many polymers, to reduce the viscosity of long chain polymers and allow them to process.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 6.2: Testing of Rubber Compounds

### Unit Objectives

At the end of the unit, students will be able to:

1. Prepare Sample
2. Identify rubber compounds
3. Perform tests like specific gravity, viscosity

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Wallace Plastimeter.
- Rotational Viscometer.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Give the participants a brief introduction about the unit.

## Elaborate

Tell them – As already mentioned in the earlier session quality control includes raw material testing, in process testing and finished product testing. The consumer is interested in the properties of the finished product, whereas the supplier is concerned about the properties of the raw and compounded rubber. Even if good quality uniform raw materials are used there will be non-uniformity in products because of variation in mixing conditions.

## Say

- Tell the participants about the Sample Preparation. Mixing and moulding for test sample preparation is described in the next session. Where compounded and unvulcanized rubbers are taken for testing they should be homogenized well and proper conditioning should be given.
- Tell the participants about the Rubber Compounds.

## Elaborate

- Tell them – Rubber compounds after mixing, but before processing and curing, are tested by physical test methods to have a check on the processing behavior. Some of the important tests are specific gravity, viscosity, plasticity, scorch time, cure time, tack, green strength and shrinkage.
1. **Specific gravity:** Determination of specific gravity of a rubber compound is helpful to detect the weighing errors before processing takes place.
  2. **Viscosity or Plasticity:** These tests provide processing behaviour of unvulcanised rubber compound.

Instruments used for plasticity and viscosity measurement are:

- » Compression
  - » Rotational
  - » Oscillation
  - » Extrusion
  - » Mixer type plastimeter
- a. **Compression plastimeters (Wallace Rapid Plastimeter):** A small cylinder of the rubber is compressed (1 mm thickness) between parallel plates under a definite force (10 Kg) for a definite time (15 seconds), normally at elevated temperature, (100°C) the compressed thickness being the plasticity number .
  - b. **Rotational viscometer**
    - **Mooney Viscometer:** The test consists of determining the torque necessary to rotate a disc in a cylindrical chamber filled with rubber under specified conditions.
    - **Mooney Viscosity:** It is measured by mooney viscometer and is defined as the torque on instrument's rotating spindle within heated dies (the rubber compound must enclose and overflow the spindle in order for the measurement to be accurate).
  - c. **Mooney Scorch:** The Mooney viscometer is used to measure scorch, i.e. the onset of vulcanization.
  - d. **Oscillating Disc Rheometer (ASTM D 2084):** The Monsanto Oscillating disc rheometer is designed to measure

the complete curing characteristic of a single rubber compound, heated and maintained under continuous pressure during vulcanization.

**e. Rotor less cure meter (ASTM D 5289):** Moving die rheometer (MDR) is a popular example for this type.

Problems with ODR like delayed temperature recovery, limitation in studying true dynamic properties, practical difficulty in using film to keep the dies from fouling since the rotor has a shaft, were overcome with the introduction of MDR.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 166 - 171 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 6.3: Testing of Rubber Products

### Unit Objectives

At the end of the unit, students will be able to:

1. Perform physical testing of rubber products
2. Undertake rubber product tests like hardness test, tensile strain/stress test, tear test, abrasion test, flex cracking test, heat buildup test, rebound resilience tests,
3. Identify electric and temperature properties of rubber products

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Durometer.
- Universal testing machine.
- Stress relaxation tester.
- Compression set.
- Goodrich Flexometer.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Mastication, Master Batching and Final Mixing in this unit of the program.

### Say

- Give the participants a brief introduction about the unit. Rubbers being complex materials exhibit unique combination of properties and infinite number of compounds is possible, hence they need their own test methods.

## Elaborate

- Tell them – Physical testing of the rubber vulcanizates is necessary to trace out the short falls in processing methods, to control and maintain the quality of products and to undertake research and development work.
- Even though it is true that the basic polymer properties have a profound influence on the actual service life of a product, it also depends on processes involved in the fabrication of the product. In certain products like tyres, hoses, V-belts etc. the design of the product also equally affects the final performance.

## Say

- Tell the participants about the Physical Testing of Rubber Vulcanizates. Before actual testing following precautions should be done:
  - » Calibrate the testing equipment using the prescribed calibration procedure.
  - » Various test conditions should be noted e.g.: temperature, atmospheric pressure, size and type of the test specimen, type of test equipment etc.
  - » Testing equipment should be in perfect order and can record or display the test reading accurately.

## Elaborate

Sample preparation contains the following:

### **Standard procedure for mixing of the compound (ASTM D3182).**

Processing variables can affect to a very great extent the results obtained on the rubber product or test piece and, a great number of physical tests are carried out to detect the result of these variables.

### **Standard procedure for moulding of the test sheet/sample (ASTM D 3182)**

**Procedure for cutting of the test sample from the test sheet (ASTM D 3183):** The test pieces can be prepared from moulded sheet by using the operation cutting or stamping.

**Procedure for test piece preparation from the finished product:** The test pieces can be prepared from the finished product by using cutting and buffing

Conditioning of the test piece before actual testing is carried out.

### **The standard conditions are:**

- 23°C and 50% humidity
- 27°C and 65% humidity

**Both humidity and temperature are controlled;** the standard conditioning time is a minimum of 16 hours.

**Testing atmosphere and temperature:** The most common application of relaxing the testing conditions is after conditioning at 23°C and 50% relative humidity to test at 23°C without humidity control.



## Say

- Tell the participants about the Hardness Test (ASTM D 1415, IS 3400 Part 2). Hardness represents the elastic modulus of material under conditions of small strain.

## Elaborate

Tell them – Hardness test involve the measurement of the depth of penetration of an indenter of specified dimensions under the application of a load either by a dead weight or by a spring. The indentation hardness is inversely related to the penetration and is dependent on the elastic modulus and viscoelastic behavior of the material. There are different types of instruments used for measuring the hardness. Some of the most popular ones are shore A Durometer, Rex Gauge, Wallace.

- Hardness Meter, the International Rubber Hardness Tester etc.
- Durometer is a small pocket type of hardness meter.

### Testing procedure

Place the specimen on a flat, hard, horizontal surface. Hold the durometer in a vertical position with the indenter tip at a distance from any edge of the specimen unless it is known that identical results are obtained when measurements are made with the indenter at a lesser distance. Apply the presser foot to the specimen, maintaining it in a vertical position keeping the presser foot parallel to the specimen, with a firm smooth downward action that will avoid shock, rolling of the presser foot over the specimen, or the application of lateral force. Apply sufficient pressure to assure firm contact between the presser foot and the specimen. Make five determinations of hardness at different positions on the specimen at least 6.0 mm (0.24 in.) apart and calculate the arithmetic mean. There are three types of durometers for different category of products.

- Shore 0: for sponge rubber in degree.
- Shore A: for soft rubber in degree
- Shore D: for hard rubber in degree

## Say

- Tell the participants about the Tensile stress/strain (ASTM D 412, IS 3400 Part 1). If rubber is stretched or mechanically deformed, it means a strain is applied to the material, as a result of an applied pressure called stress.

## Elaborate

Tell them – There are different modes of strain, such as tensile, compression, shear and torsion. Mostly used strain mode is tensile. Tensile testing is accomplished by moulding a flat sheet of rubber. By the tensile testing of a rubber vulcanizate three parameters i.e., the tensile strength, elongation at break and modulus at a particular

elongation of the sample are obtained at a time. Tensile strength is defined as the force per unit area of original cross section of the sample required to stretch a rubber test piece to its breaking point. Modulus is the tensile stress required to stretch a rubber test piece to a predetermined elongation. Elongation at break is the maximum elongation, expressed as the percentage of the original length, prior to the rupture of the sample. The tensile testing machine can also be used to find the tension set i.e., the extension remaining after a specimen has been stretched and allowed to retract in a specified manner, of the sample.

### Say

- Tell the participants about the Tear Tests: (ASTM D624, IS 3400 Part 17). Tear strength is defined as the force per unit thickness required to cause a nick out in a rubber test piece to extend by the tearing of the rubber when it is stretched, under constant rate, in a direction perpendicular to the plane of the cut. The tear test can be performed using the tensile testing machine. There are different types of test pieces used for conducting the tear tests.
- Also tell the participants about the Set, Creep and Stress Relaxation: (IS 3400 Part 1-1977).

### Elaborate

- Tell them – The deformation that remains in an elastomer after the removal of an applied stress or strain is “Permanent Set”.
- When a constant load is applied to an elastomer the deformation is not constant but increases gradually with time, this behaviour is known as “strain relaxation” or “Creep”.
- When an elastomer is subjected to a constant strain, a decrease in stress takes place with time, this behaviour is called “stress relaxation”
- The phenomena of permanent set creep and stress relaxation are the result of physical and chemical changes in elastomer, both of which occur simultaneously.

### Say

- Tell the participants about the Set Properties: (ASTM D 395, IS 3400 Part 10). Compression set in rubber may be defined as the amount (percent) by which a standard test piece fails to return to its original thickness after being subjected to a standard compressive load or deflection for a specified period of time. It depends on time for which test is conducted and time allowed for recovery.

### Elaborate

- Explain – Whether the testing is done under constant stress or strain, it involves compressing of the test specimen between two parallel plates and keeping it in that position for a specified period at a particular temperature. After the specified time, it is taken out and kept at room temperature for half an hour.

**Time:** temperature conditions may be either 22 hours at 70°C or 70 hours at 100°C, depending on the type of rubber.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No.176 explain trainees' the concept.

## Do

Discuss with the participants about the Accelerated ageing tests (IS 3400 Part 4-1987). The natural deterioration of the vulcanizates under the action of heat, light, oxygen, ozone, etc. is termed as 'ageing'. The service life of a product is too long to wait for getting information regarding the performance of the product under the influence of the above mentioned agents. It is therefore necessary to test the product, under conditions which can produce accelerated ageing effects to get some idea of the service life and performance of the product.

## Say

- Tell the participants about the Abrasion Tests: (ASTM D5963-2004 IS 3400 Part 3). Abrasion resistance may be defined as the resistance of the rubber vulcanizate to wearing away by rubbing or impact during service. The principle involved in the test is to rub the test sample against a standard rough surface, such as sand paper for a specified time.
- Also tell the participants about the Flex-Cracking and Cut –Growth Tests.

## Elaborate

Explain – Products like tyres, conveyor belts; shoe soles etc. are subject to repeated flexing during service. This repeated flexing may gradually lead to failure of the product.

Resistance to flex cracking consists of two parts, i.e.

- Resistance to crack initiation (ASTM D 430-06, IS 3400-Part7-1985)
- Resistance to crack growth (ASTM D 813-07, IS 3400 Part8-1983)

In Crack growth testing, a crack is initiated purposely by means of a specially shaped tool and the rate of growth of the cut is measured during flexing.

**Say** 

- Tell the participants about the Heat Build Up: (ASTM D623 Method A). This is an important property for tyre tread where fatigue is caused by repeated cyclic deformation. Subjecting a rubber to repeated deformation cycles results in a change in stiffness and a loss of mechanical strength. Heat build –up’ type of fatigue test is carried out on an apparatus generally called a Flexometer which operate in compression, shear or a combination of the two.
- Discuss with the participants about the Rebound Resilience Test.

**Elaborate** 

Tell them – In rubber, resiliency may be defined as the ratio of the energy returned to the impressed energy i.e. Resilience is a measure of the ability of the rubber vulcanizate to return the energy used to deform it. Various testing machines like the Dunlop Tripsorneter, Yertzley Oscilograph, Lupke Impact Resiliometer etc. are used for determining the rebound resilience.

**Say** 

- Tell the participants about the Low Temperature Properties and Electrical Properties.

**Elaborate** 

Tell them – The low temperature performance of the rubber vulcanizates is usually estimated by determining the freeze point and brittleness temperature of the vulcanizates. The freeze point is defined as the temperature at which the modulus is ten times its value at 200c. Brittleness temperature is the temperature, estimated statistically at which 50% of the specimens would fail in the specified test.

Rubber vulcanizates can be used as a good insulator in applications like wires and cables. But in certain cases like antistatic mountings it is made conductive by proper compound designs. Dielectric strength is a measure of the ability of insulation to withstand Voltage. The dielectric constant or specific inductive capacity is a measure of the insulations ability to store electrical energy. The power factor of an insulating material indicates its tendency to generate heat in service. If a capacitor using an elastomer as the dielectric is charge and then immediately discharges, there is an energy loss in the form of heat. The surface resistivity of a test piece is determined by measuring the current passing under an applied D.C.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## Activity

- Divide the class into two equal groups and name them Group A and Group B.
- Tell participants they have to demonstrate the different types of testing of rubber products.
- Tell them they would be given a time of 30 minute for preparation. The time for presentation for each group should not exceed 30 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Explain about types of rubber products	3 hour	Charts d





**Skill India**  
वीरता मरण-पूर्वक मरण



## 7. Standards and Safety

Unit 7.1 – Standards and Specifications – Systems

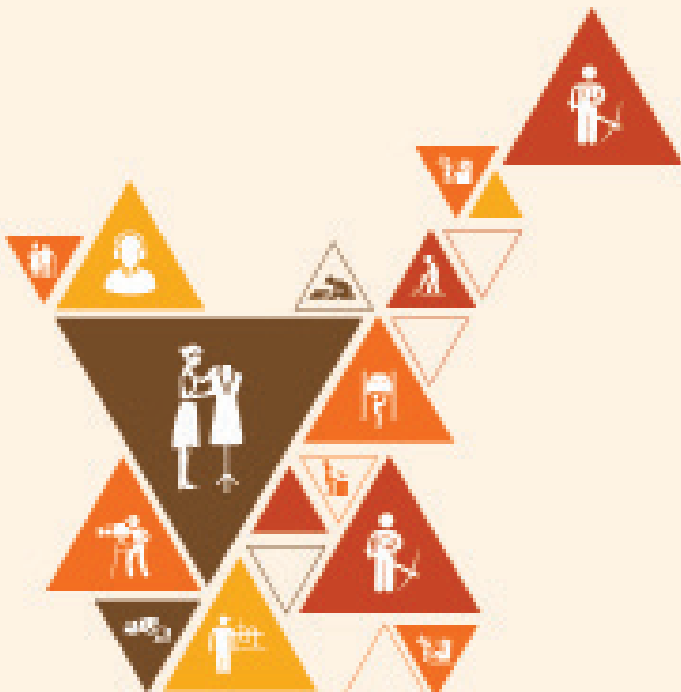
Unit 7.2 – Standards and Specifications – Products

Unit 7.3 – Safety Aspects Related to the Machine Operation

Unit 7.4 – Safety at Workplace

Unit 7.5 – Good Manufacturing practices – 5S concept

Unit 7.6 – First Aid and CPR



## Key Learning Outcomes

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

1. Understand the quality control and its systems
2. Understand the concept and role of ISO – 9000 and ISO - 9001
3. Know about the product realization



## UNIT 7.1: Standards and Specifications – Systems

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand the quality control and its systems
2. Understand the concept and role of ISO – 9000 and ISO – 9001
3. Know about the product realization

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Standards and Specification – Systems in this unit of the program.

### Say

- Tell the participants about the Quality Management. Quality management is an important well defined term applicable to almost all business sectors to ensure consistent good quality products/services so that the reliability of the organization is well maintained among the customer front. This can be achieved only through proper quality planning, quality control, quality assurance and quality improvement practices.

## Elaborate

- Explain – The Japanese companies started the quality movement in 1950s with the introduction of Statistical Process Control and problem-solving techniques which made them competitive with American companies on account of their capability to produce higher quality products with fewer defects. A quality management system (QMS) is a management technique used to communicate to employees what is required to produce, the desired quality of products and services and to influence employee actions to complete tasks according to the quality specifications. ie. Quality management is focused not only on product/service quality, but also the means to achieve it. Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality.

### Objectives of QMS

- Quality is built at every stage/activity/process, through conformance to requirements.
- Formalized quality management system, advanced quality planning & ease of working.
- Defect prevention, reduction of process variations and elimination of internal/external losses.
- Enhancing the effectiveness and efficiency of productive activities/processes.
- Continuous improvement/ customer satisfaction.
- Compliance to govt./statutory regulations

## Say

- Tell the participants about the Systems for Quality Management.

## Elaborate

Tell them – A few systems for quality management are as follows:

1. ISO – 9000 (QMS-Design, Manufacture, Marketing, Servicing)
2. ISO – 14000 (Environmental Management System)
3. ISO – 27001 (Information Security System)
4. ISO- 13485(the medical industry's equivalent of ISO 9001)
5. OHSAS 18001 (Occupational Health and Safety Management System)
6. TPM – Total Productive Maintenance
7. TQM – Total Quality Management
8. Continuous Quality Improvement (CQI)
9. Six sigma
10. 5S – (Work space management-Sort, Set in order, Shine, Standardize, Sustain)
11. Kaizen
12. Good Manufacturing Practice (GMP)
13. Lean manufacturing

## Say

- Tell the participants about the concept and role of ISO – 9000. ISO 9000 is a series of quality management system standards created by the International Organization for Standardization (Headquarters – Geneva), a federation of 132 national standards bodies.

## Elaborate

Tell them – ISO released six quality standards – ISO 8402, ISO 9000, ISO 9001, ISO 9002, ISO 9003, and ISO 9004. ISO standard is a published document outlining the specification, features, characteristics and requirements to be met by every operation, every functional areas, every procedures, every records and everywhere in the organization.

- ISO – 9000 series promote standardized management of quality systems in order to achieve global standard.
- **Characteristics of ISO – 9000**
  - » Series of minimum acceptable level of standards that a supplier’s quality management practices should meet.
  - » Define basic elements of quality system through documentation.
  - » Ensures uniform systems that are universally recognized and accepted.
  - » Creates the discipline required for total quality management.
  - » Promote standardization and international exchange of goods & services.
- **Elements of ISO – 9000**
  - » ISO-9000 standards consist of six parts (ISO 8402, ISO 9000, ISO 9001, ISO 9002, ISO 9003, ISO 9004) are really guidelines for managing quality rather than being ‘standards’.
  - » Audit verifies whether supplier is following these internationally agreed guide lines.
  - » Standards are not govt. regulations; rather these are customer requirements in certain contractual situations.
  - » Standards do not specify any particular procedure for controlling quality.

## Say

- Tell the participants about the concepts and requirements of ISO – 9001. ISO 9001 was prepared by Technical Committee ISO/TC 176. ISO 9001 specifies the requirements for a QMS that may be used by organizations for internal application, certification or contractual purposes. It is compatible to meet the expectations of customers and interested parties.

## Elaborate

- Tell them – The eight Quality Management Principles provide the basis for the performance improvement.
  - » Customer Focus
  - » Leadership
  - » Involvement of people
  - » Process approach
  - » System approach to management
  - » Continual improvement
  - » Fatal approaches to decision making
  - » Mutually beneficial supplier relationships

### ISO 9001- Quality Management System requirements

QMS requirements explain what should be done to become an ISO 9001:2008 company in order to get effective implementation of projected programs.

#### General Requirements: The organization should,

- » Determine the sequence and interactions of processes.
- » Establish the criteria and methods for controlling the processes.
- » Make available the necessary resources and information for implementing and monitoring the processes.
- » Monitor, measure and analyse these processes.
- » Take action to achieve planned results and continual improvement of the processes.

#### Documentation Requirements:

- » Quality policy and objectives
- » Quality manual
- » Documented procedures
- » Documents needed to plan, implement and control the processes
- » Necessary records

All documents should be reviewed and approved by authorized personnel. Obsolete documents should be removed and new ones to be made available at point of use. Records are to be maintained for a defined minimum period and should be kept in a ready retrievable manner.

#### Management Responsibility

Management should be committed to develop and implement the QMS and continually improve its effectiveness.

#### The top management shall

- » Ensure that customer requirements are determined and met.
- » Make an appropriate quality policy and ensure that it is communicated and understood within the organization.
- » Define and communicate the responsibility and authority of the various levels of employees.

- » Appoint a member of the organization as “Management representative” who ensures that the system has been established and maintained and reports to the management on the performances of the QMS.
- » Ensure that all employees follow it in their work.
- » Ensure effective communication processes are established.
- » Conduct regular review meeting to verify the adequacy and effectiveness of QMS and decide upon actions for improvement.

### Resource Management

Management has to identify and provide the necessary resources to implement, maintain and improve the effectiveness of QMS for meeting customer requirements.

- » Human Resources: Ensure that persons performing work are competent to do the job.
- » Infrastructure: Provide necessary building, workspace, lighting, ventilation, equipment and basic services to work.
- » Work environment: Provide necessary work environment to provide product/service delivered to the customer is defect free.

### Say

- Tell the participants about the Product Realization.

### Elaborate

**Planning of product realization:** The organization shall plan and develop the process needed for product realization. It should be consistent with the requirements of the other process of the system.

#### Customer related processes

The organization shall

1. Determine the requirements related to the product like customer requirements, statutory requirements, organizational requirements and any other specified.
2. Review the requirements like product requirements, contract or order requirements etc.
3. Communicate to the customer about product information, order handling, amendments etc.

#### Design and Development

1. Planning
2. Inputs
3. OutputsVerification
4. Validation

#### Purchasing

1. Purchasing process
2. Purchasing information

**Production and service provision**

1. Control of Production and Service Provision
2. Validation of the process for production
3. Ultimate output is ensured.
4. Identification and traceability
5. Customer property
6. Preservation of product

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 187 - 189 explain trainees' the concept.

**Say** 

- Tell the participants about the Control of Monitoring and Measurement Equipment. To ensure valid results, measuring equipment shall:
  - » Be calibrated
  - » Be adjusted as necessary
  - » Have identification to check the calibration status
  - » Be safeguarded from errors
  - » Be protected from deterioration during handling

**Elaborate** 

- Explain – Measurement, Analysis and Improvement

Monitoring and measurements are essential for analysis which helps for continually improving the quality management system.

**Monitoring and measurement**

1. Customer satisfaction
2. Internal audits
3. Monitoring and measurement of process
4. Monitoring and measurement of product

**Control of non-conforming product:** A product which does not conform to the standards is identified and its unintended usage is prevented.

**Analysis of Data:** Analysis of data provides information relating to customer satisfaction, trends of processes and products, opportunities for preventive action and supplier's performance in order to continually improve them

**Improvement:** Organization should take action to continually improve the effectiveness of QMS through quality policy/ objectives, audit result, data analysis, corrective and preventive action and management reviews.

**Corrective action and preventive action:** The organization shall take action to eliminate cause of non-conformities in order to prevent their re-occurrence.

## Say

- Tell the participants about the Total Quality Management (TQM). TQM describes a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.
- Discuss with the participants about the Total Productive Management (TPM) and Continuous Quality Improvement (CQI).

## Elaborate

- Tell them – TPM is a management process developed in Japan in 1971 for improving productivity by making processes more reliable and less wasteful. TPM is an extension of TQM.

### TPM results in,

- » Productivity enhancement
- » Cost Reduction
- » Delivery period shortening
- » Sales Expansion

Continuous Quality Improvement (CQI): Continuous quality improvement is a tool for improving the quality of services provided by organizations.

### The process involves:

- » Identifying improvements
- » Implementing the improvements
- » Evaluating the effect of improvements and
- » Going back to identify more improvements.

## Say

- Tell the participants about the Six Sigma. Six Sigma is a set of tools and techniques/strategies for process improvement originally developed by Motorola in 1985. Its overall goal was to measure and eliminate waste by attempting to achieve near perfect results.

## Elaborate

Tell them – Six Sigma refers to a statistical measure with no more than 3, 4 defects per million opportunities (DPMO), which means that 99.9997% of the products are free from any defects. Six Sigma is a statistically oriented approach to process improvement by identifying and removing the causes of defects (errors) and minimizing

variability in manufacturing and business processes.

**The steps involved in the six sigma process are:**

- » Define the defects
- » Measure the number of defects
- » Probe for the root cause
- » Implement changes to improve
- » Re measure
- » Take a long-term view of goals

The quality management practices like Five S (5S), Kaizen, Good Manufacturing Practice (GMP), Lean Manufacturing etc. are also widely practiced.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



## UNIT 7.2: Standards and Specifications – Products

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand various quality standards required to be fulfilled by a product
2. Identify BIS specifications for rubber products
3. Identify standards to conform for pharmaceutical usage of rubber
4. Identify other quality standards rubber products.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Standards and Specification – Systems in this unit of the program.

### Say

- Give participants a brief introduction about the unit. You have already familiarized with general laboratory tests for rubbers, rubber compounds and vulcanizates which are essential in rubber industry for quality control and maintaining consistency in product quality. However, what all tests are to be carried out for a particular product and what are the minimum value requirements for the tests are decided based on the specification laid down for the product.

## Elaborate

Explain – The specification standards are usually laid down by a competent body- national, international or individual organization-in consultation with a technical committee constituted by it for this purpose. Standards in general are documents published by a National or International body in consultation with a technical committee. Standards can be:

- Specification which specifies the minimum requirements for materials or products
- Method of test describing the test procedure
- Glossary of terms or
- Guides and codes of practices.

A specification usually refers to many nationally and internationally developed standard test methods

**Organisations producing Standards can be:**

- » International organisations
- » National organisations
- » Individual organizations.

International standards being unique for all countries are helpful for international trade and exchange of technical information. The principal international body in the standards field including rubber is ISO, the International Organisation for Standardisation commonly referred to as the International Standards Organisation

**National organizations developing standards are:**

all tests are to be carried out for a particular product and what are the minimum value requirements for the tests are decided based on the specification laid down for the product.

Standards in general are documents published by a National or International body in consultation with a technical committee. Standards can be:

- Specification which specifies the minimum requirements for materials or products
- Method of test describing the test procedure
- Glossary of terms or
- Guides and codes of practices.

A specification usually refers to many nationally and internationally developed standard test methods.

**Organisations producing Standards can be:**

- International organisations
- National organisations
- Individual organizations.

International standards being unique for all countries are helpful for international trade and exchange of technical information.

**National organisations developing standards are:**

1. British - British Standards Institution (BSI)
2. America

- American Society for Testing and Materials (ASTM)
- American National Standards Institute (ANSI)

3. French - NIFT

4. German - DIN

5. Indian - IS

Company standards: Since many of the rubber products are ancillary items to industries, the quality control of such items depends on company standards or individual organisation standards.

In the quality control of a rubber product all tests are carried out as per the specification laid down for the product and look for its compliance with the specification requirements.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No 192 - 193 explain trainees' the concept.

## Say

- Tell the participants about the BIS specifications for Rubber Products. In India, Bureau of Indian Standards (BIS) is the competent authority to prescribe standards in consultation with a technical committee consisting of members representing manufacturers, processors, consuming sectors, Govt agencies etc. BIS specifications for rubber and rubber products have been oriented to internal needs as well as to requirements of export market.
- Also tell the about the Rubber Microcellular Sheets for Soles and Heels-Specification.

## Elaborate

Tell them – IS 6664: 1992- Prescribes the requirements, method of sampling and test for rubber microcellular sheet for making cut soles and heels produced by moulding process form general purpose elastomers and intended for use in footwear.

IS 6664: 1992- Prescribes the requirements, method of sampling and test for rubber microcellular sheet for making cut soles and heels produced by moulding process form general purpose elastomers and intended for use in footwear.

### Requirements:

- **Materials:** Rubber used shall be compounded from natural or synthetic rubbers or their blends.
- **Size and Thickness:** Thickness shall be agreed between purchaser and manufacturer but not less than 5mm. Size of cot soles and heels shall be according to IS 1638:1963, tolerance on agreed thickness shall be  $\pm 0.5$ mm.

### Method of Test:

1. Relative Density
2. Hardness using Shore A Durometer
3. Change in Hardness after Ageing at  $100 \pm 1^\circ\text{C}$  for 24hours
4. Compression Set at Constant Stress

5. Split Tear Strength
6. Clamp the tongues of test piece in the jaws of tensile testing machine and allow jaws to separate at a constant rate of 75mm per minute.
7. Room Temperature Shrinkage
8. Heat shrinkage test at  $100^{\circ}\text{C}\pm 1^{\circ}\text{C}$  for 1 hour
9. Water Absorption

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and page No. 194 - 196 explain trainees' the concept.

## Say

- Tell the participants about the Rubber Closure, Pharmaceutical – Specification. IS 3692: 1975- prescribes the requirements and methods of sampling and test for rubber closures suitable for steam sterilization and intended for use with vials of injection products in the form of aqueous solution or solids to be reconstituted before use.

## Elaborate

Tell them – The requirements of Rubber Closures, Pharmaceutical – Specification is as follows:

IS 3692: 1975- prescribes the requirements and methods of sampling and test for rubber closures suitable for steam sterilization and intended for use with vials of injection products in the form of aqueous solution or solids to be reconstituted before use.

### Requirements

**Materials :** The closure shall be made from natural or synthetic rubber or their blends suitably compounded and vulcanized. It shall be non-porous, smooth finished and free from embedded foreign matters, grease or pigments, blisters, dust, fibers and loose particles of rubber. The closure of each batch shall be uniform colour.

Dimensions of rubber plugs intended for use as closures for glass vials conforming to IS:

1984(Part 1):1971.

### Method of test for Rubber Closures, Pharmaceuticals:

1. Sterilization Test
2. Test for Extractable Matter
3. Fragmentation Test

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 197 explain trainees' the concept.

## Say

Tell the participants about the Hospital Rubber Sheeting's – Specification. Indian standard – IS 4135: 1974 prescribes the requirements and methods of sampling and test for hospital rubber sheeting's (cotton or synthetic Indian standard – IS 4135 : 1974 prescribes the requirements and methods of sampling and test for hospital rubber sheetings (cotton or synthetic fabric coated on both sides with rubber)

## Elaborate

### Requirements:

**Fabric :** Base fabric used for the hospital rubber sheetings shall be made of cotton, viscose staple or other suitable textile material agreed between purchaser and supplier.

### Finished Fabric

1. **Length:** Length of each piece of finished sheeting shall not be less than 30 meter.
2. **Width:** The usable width shall not be less than 1100mm,
3. **Waterproofness Test:** there be no percolation of water or wet patches of water on the surface in contact with air when a constant head of water for 60minutes.
4. **Aqueous Extract Test**
5. **Xylol Resistance Test** The rubber coating shall not become tacky or separate from base fabric.
6. **Phenol Resistance Test:** The test piece shall show no softening of the coating or any other change which might adversely affect serviceability of the sheeting.
7. **Disinfectants and Detergents Resistance Test:** The test pieces after immersion shall not show softening of coatings or any other change which might adversely affect serviceability of sheeting.
8. **Ageing Resistance Test:** after test samples shall not become stiff or tacky or shall it show appreciable discoloration or be easily detachable from the base fabric.
9. **Autoclaving Test:** Put test pieces of 100mm<sup>2</sup> into an autoclave maintaining steam pressure of 1kgf/cm<sup>2</sup> for 20minutes.
10. **Colour:** The finished material shall not stain cotton wool swab when rubbed dry or wet on it.
11. **Fastness to washing:** The material when tested for colour fastness to mechanical washing in accordance with IS 765:1966 shall show a fastness rating of not less than 5.
12. **Fastness to light:** The material when tested for colour fastness prescribed in IS 2454:1967 shall show a fastness rating of not less than 3.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 199 - 200 explain trainees' the concept.

## Say

- Tell the participants about the Agricultural Produce Milling Machine (Rubber Roll) for Paddy Dehusker. Indian Standard – IS 8427:1989 specifies material, dimensions and other requirements for rubber rolls used in paddy dehusker.

## Elaborate

- Tell them – The types of Rubber Rolls are of two types:
  - » Type A – Rolls of black colour
  - » Type B – Rolls of white or any colour other than black

**Materials:** Rubber roll shall be made from natural or synthetic rubber or blend of both. It shall not contain scrap or reclaimed rubber.

**Metal part of roll** shall be made of cast iron (as per IS 210:1978) or plain or perforated sheet (as per IS 513:1986) or wire mesh.

### **Physical Properties:**

Test for Tensile strength of rolls shall be carried out in accordance with IS 3400(Part 1)

**Hardness:** Hardness for both types of rubber rolls shall be 85 to 97 IRHD (International Rubber Hardness Degree). Test shall be conducted in accordance with IS 3400(part 2):1980

**Abrasion resistance:** Test shall be conducted in accordance with IS 3400(part 3):1987

**Adhesion of rubber to metal:** Test shall be conducted in accordance with METHOD A of IS 3400(PART 14):1987

### **Other requirements**

- Rubber rolls shall be uniform in construction
- Rubber surface shall be free from bloom sulphur
- Rubber rolls may be provided with one or two tapped holes for 8mm size bolt, distance from centre of hole to outer surface of the roll shall be 50mm.

## Say

- Tell the participants about the Conveyor and Elevator Textile Belting – Specifications.

## Elaborate

Indian Standards generally followed by the Industry in this sector are:-

- **IS 1891: Part 1:** Conveyor and Elevator Textile Belting- General Purpose Belting
- **IS 1891: Part 2:** Conveyor and Elevator Textile Belting- Heat Resistant Belting
- **IS 1891: Part 3:** Rubber Conveyor and Elevator Textile Belting - Oil Resistant Belting
- **IS 1891: Part 4:** Rubber Conveyor and Elevator Belting -Hygienic Belting
- **IS 1891: Part 5:** Conveyor and Elevator Textile Belting - Fire resistant belting for surface application
- **IS 3181:** Conveyor belts - Fire Resistant conveyor belting for underground mines and such other hazardous applications

**Standard covers the requirements of rubber/plastics conveyor and elevator textile belting for general use on flat or troughed idlers**

**Construction:** The belting shall consist of a carcass having a cover of either rubber or plastics. The carcass

**Fabric:** Fabric is made of cotton or polyamide or any other synthetic material or combination of thereof.

**Cover:** The rubber used in the top or bottom cover shall be one of the following grades M-24, N-17, N-17(synthetic).

Method of tests:

- » **Tensile strength and elongation at break of rubber cover**
- » **Abrasion loss of rubber cover**
- » **Net length of endless belting**
- » **Full thickness breaking strength and elongation**
- » **Adhesion test**
- » **Trough ability of conveyor belting**

## Say

- Tell the participants about the Vee Belts. Indian Standards generally followed by the Industry are:
  - » IS 2494: Part 1: V-Belts - Endless V-Belts for Industrial Purposes - General Purpose
  - » IS 2494: Part 2: V-belts - Endless V-belts for industrial purposes: Fire resistant and antistatic V-belts
  - » IS 5635: Automotive V-Belt Drives

## Elaborate

Indian Standards generally followed by the Industry are:

- **IS 2494 : Part 1 :** V-Belts - Endless V-Belts for Industrial Purposes - General Purpose
- **IS 2494 : Part 2 :** V-belts - Endless V-belts for industrial purposes: Fire resistant and antistatic V-belts
- **IS 5635:** Automotive V-Belt Drives

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.



## UNIT 7.3: Safety aspects related to the Machine Operation

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand health and safety related to operations of machines.
2. Take care of health and safety while mixing and finishing operations.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Safety aspects related to the machine operation in this unit of the program.

### Say

- Give participants a brief introduction about the unit. This session has been prepared adapting the relevant points from the ILO (International Labour Organisation) document about safety in tyre industries and non-tyre rubber industries, and also from a published literature 'Tread Safely' by the HSE (Health and Safety Executive) of the UK government working in the area of industrial health and safety.

## Elaborate

- Tell them – Accidents and ill health caused by work can have an enormous human cost, both in terms of the pain and suffering experienced by the person who is injured or becomes ill, and through the effects that this can have on their family and home life.
- The unsafe activity and practice in a rubber industry can be classified to two primarily – one related to operations as carried using machinery, and the other, as related to the working conditions, nature of the job, and exposure to the various materials which can cause to health and safety issues if handled inappropriately.

## Say

- Tell the participants about the Health and Safety related Operations of Machines.

## Elaborate

- Tell them – The activities using mill knives are as follows:
- The knives by itself, even though cannot be considered as a machine, are discussed here as a separate section since it forms a part of many of the machine centres and is a potential agent to cause accidents while using it. Knives often referred to as the mill men knives in the rubber industry, are of various types.
- Accidents involving hand knives can lead to serious injuries.

The general activities towards reducing the knife injuries are:

- Try to eliminate hand knives wherever possible
- Specify the right knife
- Ensure spare knives and blades are kept available
- Provide safe arrangements for storing and carrying knives
- Specify and provide the right personal protective equipment (PPE)
- Train employees to use their knives safely
- Ensure there is adequate first-aid cover
- Supervise and monitor compliance with your rules for use of hand knives

There are special knives designed for relatively safe operations while handling compound on mill. They shall have ergonomically designed handles and adjustable knife tips which are otherwise concealed inside the handle itself.

## Say

- Tell the participants about the Mill Operations. The general threat in operations where mill is involved is the risk of body or body parts getting trapped into the rolls.

## Elaborate

- Tell them – Operating the mill for whatsoever applications like the mixing of the compound, or the warming up of stock on the mill or organizing stock feed from the mill calls for working in close proximity with the open rolls of the mill. The rolls are ergonomically placed at the waist levels of the operator and this position prevents any accidental leaning forward into the mill. Most of the mill trap cases are about hand getting caught while handling the compound on mill like cutting, cross feeding etc.

The stocks on mill are generally too hot for the tender skin to bear safely. It is a must that the operators wear special gloves which are designed for this job. In the event of a hand caught In many of the mills it is a part of the mill emergency stop itself.

## Say

- Tell the participants about the Internal Mixer Operations. Internal mixers are such machines that do not require close human intervention to lead to a situation of major accident. However if the operator not careful enough, to note a machine safety system such the temperature interlock of the machine is not functional, the dumping of the batch at extreme high temperatures could cause a fire and therefore resultant damages.

## Elaborate

Tell them – The other operations where the people can get damaged from an internal mixer is about the moving parts of the machine such as its gears, motor fly wheels etc, which are normally close guarded to prevent accidental human interference on to it.

The general interlocks of machine safety that is designed as a part of the machine, to safeguard the man, machine and materials in an internal mixer are:

- High dust stop temperature
- Abnormal batch temperature
- High-High Temperature
- Machine over ride condition

### Double batch loading

- To prevent double batch loading ,charging conveyor will be enabled only after the discharge door completed its sequence of opening and closing
- Weighing conveyor should not Move forward in auto mode while charging conveyor is feeding the material to mixer.

Cooling water temperature of motor/Drive: If temperatures rises, above the alarm limit, alarm is generated and if temperature rises, above the trip temperature, feed conveyor stops and mixer main motor stops after completing the present mixing cycle and dumping the batch.

### Extruder Operations

Extruder as a machine can cause accidents of having the operators hand caught inside the hopper, and the rotating screw causing serious damage to the hand. The general precaution in this aspect is to prevent access to the screw or ram or other parts of the machine while it is still in motion.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 206 - 207 explain trainees' the concept.

## Say

- Tell the participants about the Calender Operations. Calenders are similar to mills in their ability to cause accidents while operating them.

## Elaborate

Explain – However calenders do not call for manual operations in very close proximity to the revolving rolls. However the chances are not fully avoided also, since manual interventions to guide the feed, cut off the feed, extract the left over compound from the nip at the time of a stock changeover, guide the gum trimming mechanisms etc are required while the calender is still in operation. Here also the biggest risk is about the probability of getting the hands caught, body parts in contact with the hot roll surfaces causing hard burns etc.

Since the tyre building drum rotates (fast enough to cause an accident) in front of the operator in various stages of assembly. The drum has to be open without guards to facilitate his working on the machine and also to facilitate the removal of the finished tyre from the machine.

Another possibility of accident from the tyre building machine is when the applied tread accidentally get released from the drum and throws itself off to the nearby standing operator or starts rotating along with the drum thus causing severe damage to the man and machines.

**Vulcanizers:** Moulding Presses, Autoclaves, Hot baths, Tyre Curing Presses etc.

As we have studied earlier it is the combined action of tyre temperature and pressure that makes the rubber component to vulcanise. Therefore the machinery that is designed to vulcanise the rubber will temperature in isolation or in combination with pressure. The presses and autoclaves use both these whereas the hot baths use the temperature that is supplied by a hot liquid.

The risk of operations in a curing press where the temperature, pressure are simultaneously employed are probability of traps, probability of burns and probability of bursts. Typically the equipments used in this area have inbuilt precautions against all the three.

The tyres or the articles when extracted (which is mostly manual) from the moulds after the curing process, it is very hot and can cause serious damages to the skin if it comes in contact with skin. The precautions are generally gloves made of temperature insulator materials. If the articles are too large to handle manually, they will be handled using suitable equipments.

Another possibility of damages while high pressures are used in the manufacturing process is when a sudden release of pressure happens making the objects around to fly or the parts of the vessel itself flying off causing serious personal injury.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 208 explain trainees' the concept.

## Say

- Tell the participants about the Finished Operations. De-flashing is the main finishing operation as far as moulded rubber products are concerned. It is carried out using suitable knives, or using equipments such as grinder wheels and buffing wheels.

## Elaborate

- Tell them – In the grinding and buffing operation, it is very important to hold the substrate and the tool firmly to get the desired results. Any one of these if loosely held, more importantly than affecting the accuracy of the work, it can lead to an accident.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 210 explain trainees' the concept.

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 7.4: Safety at Workplace

### Unit Objectives

At the end of the unit, students will be able to:

1. Understand health and safety related to operations of machines.
2. Take care of health and safety while mixing and finishing operations.

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the Safety at workplace in this unit of the program.

### Say

- Give participants a brief introduction about the unit. This session has been prepared adapting the relevant points from the ILO (International Labour Organization) document about safety in tyre industries and non-tyre rubber industries, and also from a published literature 'Tread Safely' by the HSE (Health and Safety Executive) of the UK government working in the area of industrial health and safety.

## Elaborate

- Tell them – This session primarily deals with the safety aspects associated with the conditions that prevail at the shop floor. It is also designed to cover the various PPEs that are used at the factory floor.
- The unsafe activity and practice in a rubber industry can be classified to two primarily – one related to operations as carried using machinery, and the other, as related to the working conditions, nature of the job, and exposure to the various materials which can cause health and safety issues if handled inappropriately.

## Say

- Tell the participants about the Health and Safety related to Work and Working Environment.

## Elaborate

### Exposure to hazardous chemicals

In general most of the chemicals that are used in the manufacture of rubber goods are safe to be manually handled and acceptable for human beings to be exposed to.

There are various national and international standards about the permitted materials to be used in the tyre industry. REACH (Registration, Evaluation, Authorisation and Restriction of CHEMicals) being enforced by the government of UK and as applicable for many other countries in EU is one such restriction of international prominence.

### Dust from Buffing, and other operations

In tyre manufacturing, dust is generated in house at the time of buffing the cured tyres for any repair to be carried out on the same. In a re-treading industry, it is a main process to develop tyre tyres for re-treading. In the case of a retread rubber manufacturing organization sandering of the cured retread materials by a process known as sandering is regular process and causes a lot of rubber dust to be generated.

### Rubber Fume

Rubber fumes which contain objectionable levels of material that is not recommended per the REACH regulation can cause cancer, and shall be prevented to the minimal levels. Fumes come out as the press opens and continue to be released from the tyre till it is cooled off.

**Solvent Vapours:** Adhesives, rubber solutions, tackifiers and sidewall paints used in the tyre and certain other rubber goods manufacturing industry contain organic solvents. These could be harmful since it evaporate fast and can be breathed in leading to headaches, nausea and other health effects.

The strategy adopted by tyre companies and such industries that use industrial hydrocarbon solvents can be listed as:

- **Elimination:** Where possible eliminate the use of solvents altogether, for example by eliminating the outside tyre paint a component that is used by the tyre maker to reduce moulded goods' defect..
- **Substitution:** If the usage of such preparations cannot be eliminated industries consider using a solvent that

is not hazardous to health.

- **Enclose the process:** Wherever possible, the process to prevent the escape of either liquid or vapour is totally enclosed.
- **Local exhaust ventilation (LEV) systems:** Providing well-designed LEV systems, at spray booths, to capture solvent vapours at the point at which they are released and prevent them reaching a person's breathing zone or entering the workroom atmosphere is common of late.
- **General ventilation:** The factory has to ensure that high standards of general ventilation exist wherever solvent vapours are likely to be present.

## Say

- Tell the participants about the Personal Protective Equipments. While working in solvent vapour atmospheres, it will be useful and required to wear the appropriate set of personal protective equipment. Aprons, Shoes, hand protective gloves and nose masks etc. are the ideal set of PPEs in this context.

## Elaborate

- Tell them – Personal Protective Equipments (PPE) as applicable or rubber goods manufacturing industry
- As the name suggests, the selection of PPE depends on the type of work that the person undertakes. For example the primary PPE for a person working in a dusty atmosphere will be the eye goggles and the nose masks.
- In an organised industry, considering the type of activity and the prevailing operating conditions that exist in the plant, the plant safety in-charge would have a prepared a list of the applicable PPEs based on the job role. This list is displayed at the work centre usually with the necessary work instructions, 'Dos and DON'Ts' etc.
  - » Safety Shoe
  - » Mill Man Gloves
  - » Nose Mask
  - » Ear Plugs
  - » Goggles
  - » Helmet
  - » Safety Harness

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 214 explain trainees' the concept.

## Say

- Tell the participants about the Noise. Some activities in the rubber goods manufacturing industry like shot blasting, tyre buffing, skiving and inflation testing can produce high noise levels.



## Elaborate

- Tell them – If employees are exposed to high noise levels for prolonged periods of time there is a serious risk of them suffering irreversible hearing loss. Occupational hearing loss is a serious, disabling condition and successful civil claims against employers for failing to prevent noise-induced deafness are common.

**First action level:** Where employees are exposed to a daily personal noise exposure of 85 decibels (dB(A)) or more actions need to be taken.

Second action level: A daily personal noise exposure of 90 dB(A) is known as the second action level. At 90 dB(A) you would have to raise your voice to make yourself heard by someone standing 1 m away.

**Reduce noise at source:** For example, fit the noisy air exhausts and extraction systems with suitable silencing devices.

**Provide acoustic enclosures:** These can significantly reduce the noise levels at the operator's working position.

**Prevent noise sharing:** Fit suitable acoustic barriers or partitions to reduce the amount of noise reaching adjacent work areas.

**Designate ear protection zones and provide hearing protectors:** If, after applying the above measures, the noise levels, although reduced, are still at or above the second action level, it is then required to mark the affected area with conspicuous noise warning signs and issue people who enter or work in the area with suitable hearing protectors.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 216 explain trainees' the concept.

## Say

Tell the participants about the Hand-Arm Vibration. Exposure to high levels of vibration from power tools can lead to hand-arm vibration syndrome (HAVS), sometimes known as vibration white finger (VWF). It is possible to control the vibration exposure to acceptable levels by taking the following precautions:

- Selection of low-vibration tools
- Limit the length of time any employee is exposed to hand-arm vibration.
- Check up for the employees for HAVS

Also tell the participants about the heat in working environment.

## Elaborate

Explain – The rubber industry uses temperature as one of the controlling parameters of the various processes that it employs in the manufacture of articles. The outputs of the various processes are hot and are cooled inside the factory thereby making the atmosphere hot. The temperature inside the factory building however, can be controlled using various methods such as:

- Reduce the heat from the source
- Ambience control
- Ventilation

- » Forced cool air supply
- » Roof insulation

### Say

- Tell the participants about the Manual Material Handling. A large percentage of all reported injuries in the industry are caused by manual handling - the transporting or supporting of loads by hand or bodily force. Most of the reported accidents cause back injury, though hands, arms and feet are also vulnerable.

### Elaborate

- Describe – It is important to battle opportunities of handling materials manually, and if manual handling cannot be avoided, to identify the best possible ways of doing the same.
- In the Indian rubber goods manufacturing industry, even today most of the material movements are manual. Movements of materials, lifting and loading of materials, rolling, stacking etc are some examples. Jobs involving repetitive lifting and placement of materials are another opportunity of stress as far as material handling activity is concerned in the rubber products manufacturing.

The following are the activities that the industry considers to mitigate the risk of manual handling of materials:

- Avoid hazardous manual handling as far as possible by augmentation using material handling equipments.
- Assess the risk of injury from any manual handling that cannot be avoided
- Reduce the risk of injury from manual handling as far as reasonably practicable

### Do

- Discuss with the participants about the Vehicle in Workplace. When more and more material handling is converted into mechanized, invariably the no. of vehicles that runs on the production floor increases and the accidents involving those increases. Forklifts, toe trucks etc. are the common mechanized vehicles that are used by the rubber good manufacture industry now a day.

The common principles of increasing the safety about these mechanized material movement vehicles are:

- Audio-visual alarms
- Corner mirrors

### Say

- Tell the participants about the fall from height injury. Falls from height is one of the most common causes of major injuries to employees. About a quarter of all fatal and major injuries each year are due to falls from ladders. Other causes include falls from scaffolding, working platforms, vehicles, roof edges, stairs, and falls through fragile roofs and from catwalks/gangways.

## Elaborate

Tell them – The mitigation of risk associated with the work at height can be systematically approached through the following steps.

- Identify all work at height
- Eliminate the need for high level working wherever possible
- Assess the risk and choose the right equipment to control them
- Ensure usage of right equipment everywhere and at all times
- Ensure the height work equipment is used safely and maintained properly

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 219 explain trainees' the concept.

## Say

- Tell the participants about the Slip injury. Slips, trips and falls on the same level are the most common cause of major injuries at work. Minimization of the risks in this category is through paying attention to the details of the root cause, and is greatly reduced by the proper housekeeping in all areas of operation.
- Also tell the participants about the behavior of an employee towards the safety. More than anything, that determines the safety of an individual working on a production floor is his own behavior only. One's behaviour can be his own 'Safety Shield' or 'Safety Hazard'. This is true in work environment as well as outside the work environment, in all walks of life. It is said that "a careful person can be safe, even in an unsafe environment".

## Notes for Facilitation

- Summarize the main points.
- Tell participants to complete the questions at the end of the sub unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.

## UNIT 7.5: Good Manufacturing Practices – 5S Concept

### Unit Objectives

At the end of the unit, students will be able to:

1. Do the good manufacturing practices
2. Understand the '5S' technique

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next unit of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell the participants they are going to learn about the 5S concept in this unit of the program.

### Say

- Tell the participants about the 5S concept. 5S is one of the most popular transfer systems of work place transformation. It is practiced world over by many enterprising organisations. Along with work place transformation it can also improve the personal make up of people if they practice it as a habit.

## Elaborate

Tell them – The 5S stands for five words of Japanese language which are translated in to English also starts with the letter 'S' They are 'Sort', 'Set to order', 'Shine' 'Standardise' and 'Sustain', This communicate the basic activities of cleaning such as segregation and removal (Sort), arrangement of items in an orderly fashion (Set to order), and 'spic & span' cleaning (Shine). The last two are about the standardisation and the sustenance of the developed practices for long.

The system was developed by the Japanese management expert Hiroyuki Hirano.

## Elaborate

Tell them – Hiroyuki Hirano. The basic philosophy of 5S is to create a clean orderly environment. Such an environment will have “a place for everything and everything in its place”. Also, 5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. 5S programs are usually implemented by small teams working together to get materials closer to operations, right at workers' fingertips. This is done by organizing and labeling materials to facilitate operations with the smallest amount of wasted time and materials. The 5S system is a good starting point for all improvement efforts aiming to drive out waste from the manufacturing process.

## Say

- Tell the participants about the meaning of First 'S'. The First 'S' Meaning is 'SORT' Technique.

## Elaborate

Tell them – To get the work place organised the first step could be to segregate the unwanted materials and remove them from the work area. Sort refers to the practice of going through all the tools, materials, etc., in the work area and keeping only essential items.

- The essence is to eliminate nonessential items from the workplace.
- The solution to all these problems and their consequences comes in the form of 'RED Tags' scheme which can be implemented very simply at the work place.
- The red tags are printed stationary to identify a suspected to be non moving material in its place of existence. It is then moved to a local red tag area, where all such materials brought from the same area are accumulated in an organised manner.
- Items are “red tagged” and stored in a local red tag area for a specific period of time, typically five days. If not reclaimed by the work group, items are then moved to one of the company's central red tag areas.

Before attempting improvement in the area, the team takes photographs of the area, for the comparison of the condition when the area is modified by the 'SORT'efforts.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 222 - 223 explain trainees' the concept.

## Say

- Tell the participants about the meaning of Second 'S'. The Second 'S' meaning is 'Set in Order'.

## Elaborate

Tell them – After their achievements in S1, the team members come together and share the insights they have gained during S1. This is the starting activity of the next phase called 'SET IN ORDER' or the second 'S'. They analyze the work area for additional improvement opportunities and look for ways to reduce sources of waste and error as well as to make the workplace more visually instructive.

The team brainstorms potential solutions, with special emphasis on using visual resources to achieve improvement.

The workplace after completion of the planned activities in S1. The actions as decided at the brainstorming are carried out. The following points are considered to be the focus of such actions:

### **Facilities/equipment/tools**

Focus is on organizing and labeling facilities and equipment.

### **Safety**

Focus is on alerting people to potentially hazardous situations and controlling actions to prevent an unsafe condition.

### **Procedures**

Focus is on employee's ability to execute job responsibilities within a given workplace.

### **Quality**

Focus is on graphically or physically representing quality standards.

**Inventory/Material Handling:** Focus is on effective identification of production and MRO materials, storeroom organization, and material movement.

### **Clearly mark**

The activity also involves the marking of the different establishments there such as the tables and chairs, machinery and also the accessories.

## Say

- Tell the participants about the meaning of Third 'S'. The Third 'S' meaning is 'Shine'.

## Elaborate

Explain – someone cleaning your room at house. First unwanted things are removed from your room, next the things are arranged in order, and thirdly the room is wiped clean and tidy. The third 'S' or the SHINE indicate nothing other than this cleaning. Shine step includes three primary activities which include:

- Getting the workplace clean,

- Maintaining its appearance, and
- Using preventative measures to keep it clean.

The difference here in comparison with the household cleaning is that the person concerned himself will be responsible for the cleaning too and there is no one coming to do it for him.

Like in the case of the two earlier 'S' here also the first step before proceeding to take up actions in shine, is to take photographs for comparison with the modified condition.

## Say

- Tell the participants about the meaning of Fourth 'S'. The Fourth 'S' meaning is 'Standardize'.

## Elaborate

Tell them – It involves documentation with respect to method of carrying out activities, schedules of activities, sharing of good practices amongst the fellow workmen and standardization of systems and practices across the organization.

In the standardization stage, it is important to have the roles and responsibilities of the different members of the crew clearly spelled out.

This can be accomplished through visual controls such as color -coding, and labeling. Checklists and schedules help to reinforce a uniform approach.

'As 5S standards are adopted into each individual work area, each location will develop unique approaches and methods to accomplishing the specified tasks and goals.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual and Page No. 225 - 226 explain trainees' the concept.

## Say

- Tell the participants about the meaning of Fifth 'S'. The Fifth 'S' meaning is 'Sustain'. The purpose of fifth S-Sustain is to maintain the momentum generated during the initial event or project.

## Elaborate

Tell them – A management auditing process should be put into practice to ensure that employees understand that maintaining the level of workplace organization is a top priority. Management audits should focus on ensuring that the routines and schedules specified in S4 Standardize are being properly maintained.

5S efforts need to be spread from one area of the plant to other and slowly the same shall spread all across the plant. The best method to do this will be making the 5S team at one area to speak about the advantages that they have realized by adopting in their work area.

## Unit 7.6: First Aid and CPR

### Unit Objectives

At the end of the unit, students will be able to:

1. Apply first aid on an injured person.
2. Follow the procedures of doing CPR.

### Notes for Facilitation

- You could ask the students about the expectations from the course.
- Invite students to participate. List the expectations on the whiteboard.
- Give the students a brief overview of what all will be covered in the program.

### Say

- First aid is the assistance given to any person suffering a sudden illness or injury, with care provided to preserve life, prevent the condition from worsening, and/or promote recovery. First aid is generally performed by the layperson, with many people trained in providing basic levels of first aid, and others willing to do so from acquired knowledge.

### Do

- Explain the importance of being aware of CPR and other First Aid methods

### Demonstrate

- Show them the CPR process on a dummy
- Show them the contents of a First Aid Box



## Activity

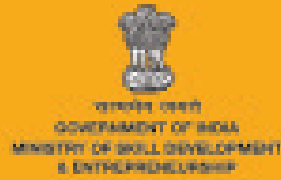
- Conduct a skill practice activity.
- Ask the students to assemble together.
- Explain the purpose and duration of the activity

Skill Practice	Time	Resources
1. Practice CPR on a dummy	1 hour	Dummy





**Skill India**  
वीरता मर्यादा - कृषि मर्यादा



## 8. IT Skills

Unit 8.1 - Introduction to Computer

Unit 8.2 - Basic Computer Knowledge

Unit 8.3 - Components of Computer

Unit 8.4 - Concept of Operating System

Unit 8.5 - MS Word

Unit 8.6 - MS PowerPoint

Unit 8.7 - MS Excel

Unit 8.8 - Internet Concepts



## Key Learning Outcomes

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

1. Familiarise with computers
2. Identify and use basic uses of a computer
3. Familiarise with a computer motherboard
4. Familiarise with a computer operating system
5. Use Microsoft Word, Excel and Powerpoint
6. Familiarise with Internet and use e-mails

## Unit 8.1: Introduction to Computer

### Unit Objectives

At the end of the unit, students will be able to:

1. Define the computer.
2. Recognise its various parts.
3. Differentiate the advantages and disadvantages of computer.

### Resources to be Used

- Participant Manual
- Computer Lab

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about introduction to computer in this unit.

### Say

- Tell participants about the computer. Computer plays a very important role in our personal and professional lives. It has become an integral part of our lives.
- Tell them about important characteristics and application of a computer.

### Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants to demonstrate the parts of computer.
- Give them 15 minutes to prepare.
- Tell them each participant will be given 10 minute to demonstrate the same.
- Once presentations are complete appreciate the efforts made by the group and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstration of Computer	4 Hours	<ul style="list-style-type: none"><li>• Participant Manual</li><li>• Computer Lab</li></ul>

## Unit 8.2: Basic Computer Knowledge

### Unit Objectives

At the end of the unit, students will be able to:

- Use computer.
- Explain the web, email services.

### Resources to be Used

- Participant Manual
- Computer Lab

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about basic computer knowledge in this unit.

### Say

- Tell participants about the application of the computer in daily life. In the workplace, many people use computers to keep records, analyze data, do research, and manage projects. At home, you can use computers to find information, store pictures and music, track finances, play games, and communicate with others—and those are just a few of the possibilities. Tell them about important characteristics and application of a computer.
- Now explain the concept of web. The World Wide Web is a gigantic storehouse of information. The web is the most popular part of the Internet, partly because it displays most information in a visually appealing format.
- Tell them about the application part of the web and introduce them with the use of different applications as email, instant messaging, picture music and movies with them.

### Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.

- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants to prepare an online report using web.
- Tell them they can choose any topic of their interest. Give them one hour to prepare.
- Tell them each participant will be given 10 minute to present their report to the class.
- Once presentations are complete appreciate the efforts made by the group and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Prepare Online report	4 Hours	<ul style="list-style-type: none"> <li>• Participant Manual</li> <li>• Computer Lab with internet</li> </ul>



## Unit 8.3: Components of Computer

### Unit Objectives

At the end of the unit, students will be able to:

- Recognise the different parts and components of computer.
- Describe the CPU, RAM and BIOS.

### Resources to be Used

- Participant Manual
- Personal Protective Equipment (PPE)

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about the components of the computer in this unit.

### Say

- Tell them about different parts of the computer.
- Explain-them about different parts of motherboard in detail.

### Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants to demonstrate the motherboard.
- Tell them they will get 30 minutes to prepare and each student will have to demonstrate for same.
- Once presentations are complete appreciate the efforts made by the group and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstration of Motherboard	4 Hours	<ul style="list-style-type: none"><li>• Participant Manual</li><li>• Computer Lab</li></ul>

## Unit 8.4: Concept of Operating System

### Unit Objectives

At the end of the unit, students will be able to:

- Familiarise with the concept of operating system.
- Work on Windows 8 and 8.1.
- Add or Remove desktop icons, make or delete a folder etc.

### Resources to be Used

- Participant Manual
- Computer System

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about operating system in this unit.

### Say

- Tell them about windows XP. And explain that Windows XP let you use different types of applications or software on the operating system.
- Familiarise them with the different versions of Windows.

### Demonstrate

- Explain tools and parts of an operating system with the participants.
- Show them all these parts practically on the computer system.
- Then explain add or delete desktop shortcut from the desktop.
- Also explain how to create a new folder.

- Tell all participants to create a folder on computer.
- Then explain how to work on multiple windows.
- Now demonstrate the keyboard to the participants and tell them the correct way to use the keyboard.

## Say

- Discuss common window commands with the participants.
- Explain the table to the participants given in the Handbook.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 186 and explain trainees' the concept.

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Give one news paper cutting to each student and tell them they need to type the same.
- Tell them they have to use correct fingers on key board and make sure work is free from errors.
- Give them one hour for typing practice and ensure that each participant is typing.
- Finally share some tips for correct typing and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Typing Practice	2 Hours	<ul style="list-style-type: none"> <li>• News paper</li> <li>• Computer Systems</li> </ul>

## Unit 8.5: MS Word

### Unit Objectives

At the end of the unit, students will be able to:

- Learn the concept of and practice MS-Word.
- Format a document.
- Print a document etc.

### Resources to be Used

- Participant Manual
- Computer System with MS Word

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about MS Word in this unit.

### Say

- Tell them about concept of word processing. Word processing skills allow us to prepare text documents such as letters, memos, and other correspondence.

### Demonstrate

- Tell them to open MS Word in their respective systems.
- Show them how to create a word document in MS word software.
- Practically demonstrate how to perform different operations on MS Word document as:
  - » Saving a Document
  - » Change Font Type and Size
  - » Create Headers and Footers by Inserting Texts

- » Indents and Spacing
- » Modifying Margins
- » Lists
- » Bulleted and Numbered Lists
- » Formatting Lists
- » Spelling and Grammar
- » Word Count
- » Different Editing Modes in Word
- » Inserting an Image and Table

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant’s manual.
- Ensure that every participant answer all questions.

## Activity

- Give one news paper cutting to each student and tell them they need to type this in MS Word and perform different operations like saving documents, Saving a Document, Change Font Type and Size, Create Headers and Footers by Inserting Texts, Indents and Spacing
- Tell them they have to use correct fingers on key board and make sure work is free from errors.
- Give them one hour for typing practice and ensure that each participant is typing.
- Finally share some tips for correct typing and summarise the highlights of the activity

Skill Practice	Time	Resources
1. Typing and Formatting – MS Word	3 Hours	<ul style="list-style-type: none"> <li>• News paper</li> <li>• Computer Systems</li> </ul>

## Unit 8.6: MS PowerPoint

### Unit Objectives

At the end of the unit, students will be able to:

- Practice MS-Powerpoint.
- Make a new presentation.
- Format a slide as well

### Resources to be Used

- Participant Manual
- Computer System with MS Office

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about MS Word in this unit.

### Say

- Tell them about the power point. PowerPoint is the presentation graphics software in the Microsoft Office suite. PowerPoint has predefined layouts, themes, and templates to create dynamic and professional presentations.

### Demonstrate

- Tell them to open MS power-point in their respective systems.
- Show them how to create a power point in MS Power-point software.
- Practically demonstrate how to perform different operations on MS Power-point presentation as:
  - » Saving a Powerpoint
  - » Working with slides

- » View tabs
- » Animating text and Images
- » Removing Animations
- » Working with Charts

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant’s manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants they have to prepare a power-point presentation on MS Powerpoint Software.
- Tell them they need to perform following operations while working on this software, Saving a Powerpoint, View tabs, Animating text and Images and inserting Charts.
- Give them one and half hour to prepare the same.
- Finally share some tips for correct typing and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Presentation on MS Powerpoint	4 Hours	<ul style="list-style-type: none"> <li>• Participant Manual</li> <li>• Computer Lab</li> </ul>



## Unit 8.7: MS Excel

### Unit Objectives

At the end of the unit, students will be able to:

- Work on MS-Excel
- Format cells and cell content
- Use formulas
- Make Charts and Pivot Table.

### Resources to be Used

- Participant Manual
- Computer System

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Ms Excel in this unit.

### Say

- Tell them about the power point. MS surpass stands for - Microsoft excel is one of the foremost common electronic spreadsheet applications supported by both mack and computer platforms. as with a paper spreadsheet, you'll be able to use excel to prepare your data into rows and columns and to perform mathematical calculations.
- Discuss the application of Excel with the participants.

### Demonstrate

- Tell them to open MS Excel in their respective systems.
- Show them how to create a spread sheet in MS Excel software.
- Practically demonstrate how to perform different operations on MS Excel as:

- » Zoom in and Zoom Out
- » Page Views
- » Change the default excel options
- » Add Command to the quick access tool bar
- » Change the default excel options
- » Cell Addresses
- » Move Across a worksheet using key board
- » Formatting
- » Calculation and Analysis
- » Change page orientation
- » Aligning Text

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants they have to prepare a spread sheet on MS Excel Software.
- Share data of a class with the participants in which participants name, height, weight and age is given.
- Tell them they need to perform following operations while working on, Add Command to the quick access tool bar, Change the default excel options, Cell Addresses, Move Across a worksheet using key board, Formatting, Calculation and Analysis, Change page orientation
- Give them one and half hour to prepare the same.
- Finally share some tips for correct data typing and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Preparing Spread Sheet on MS Excel	4 Hours	<ul style="list-style-type: none"> <li>• Participant Manual</li> <li>• Computer Lab with MS Office Software</li> </ul>

## Unit 8.8: Internet Concepts

### Unit Objectives

At the end of the unit, students will be able to:

- Understand internet concepts.
- Recognise the different types of URLs.
- Use MS-Outlook.

### Resources to be Used

- Participant Manual
- Computer with Internet

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about internet concept in this unit.

### Say

- Tell them about internet and its uses.
- Explain the concept of URL. The full form of URL is Uniform Resource Locator. It is the global address of documents and other resources on the World Wide Web. The URL is divided into two different parts. The first part of the URL is called a protocol identifier as it helps us identifying what protocol to use.
- Now tell them about different types of URLs.

## Demonstrate

- Tell them now they will learn how to open an email account in outlook.
- Demonstrate the entire process to the participants. Make sure every student should open an e-mail account.
- Now tell them how to create and send an e-mail. Explain the entire steps in detail.
- Now show them how to read an email and reply email
- Then explain attachment. The process of attaching a file or document.

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## Activity

- Tell participants they have send emails to other participants with an attachment.
- Tell them first they need to create a word, excel or power point. They can choose between any three of the formats.
- Give 2 hours for each participant for this entire activity.
- Once activity is complete share some tips of e-mail etiquette with them and summarise the highlights of the activity.

Skill Practice	Time	Resources
1. Send e-mail with attachment	2 Hours	• Computers with Internet



**Skill India**  
कौशल भारत - कुशल भारत



# 9. Employability and Entrepreneurship Skills

Unit 9.1 – Personal Strengths & Value Systems

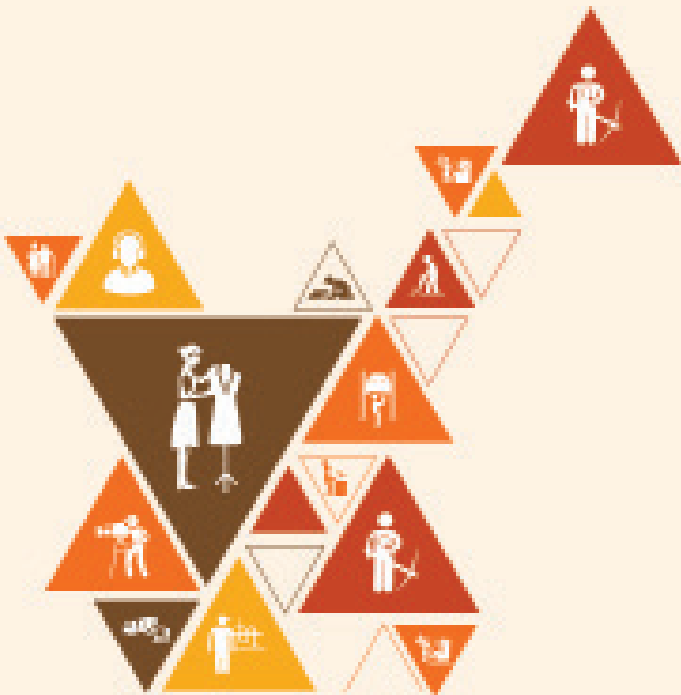
Unit 9.2 – Digital Literacy: A Recap

Unit 9.3 – Money Matters

Unit 9.4 – Preparing for Employment & Self Employment

Unit 9.5 – Understanding Entrepreneurship

Unit 9.6 – Preparing to be an Entrepreneur



## Key Learning Outcomes

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

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Understand the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Understand motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss how to maintain a positive attitude
15. Discuss the role of attitude in self-analysis
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management
32. Identify the basic parts of a computer

33. Identify the basic parts of a keyboard
34. Recall basic computer terminology
35. Recall basic computer terminology
36. Recall the functions of basic computer keys
37. Discuss the main applications of MS Office
38. Discuss the benefits of Microsoft Outlook
39. Discuss the different types of e-commerce
40. List the benefits of e-commerce for retailers and customers
41. Discuss how the Digital India campaign will help boost e-commerce in India
42. Explain how you will sell a product or service on an e-commerce platform
43. Discuss the importance of saving money
44. Discuss the benefits of saving money
45. Discuss the main types of bank accounts
46. Describe the process of opening a bank account
47. Differentiate between fixed and variable costs
48. Describe the main types of investment options
49. Describe the different types of insurance products
50. Describe the different types of taxes
51. Discuss the uses of online banking
52. Discuss the main types of electronic funds transfers
53. Discuss the steps to prepare for an interview
54. Discuss the steps to create an effective Resume
55. Discuss the most frequently asked interview questions
56. Discuss how to answer the most frequently asked interview questions
57. Discuss basic workplace terminology
58. Discuss the concept of entrepreneurship
59. Discuss the importance of entrepreneurship
60. Describe the characteristics of an entrepreneur
61. Describe the different types of enterprises
62. List the qualities of an effective leader
63. Discuss the benefits of effective leadership
64. List the traits of an effective team
65. Discuss the importance of listening effectively
66. Discuss how to listen effectively
67. Discuss the importance of speaking effectively

68. Discuss how to speak effectively
69. Discuss how to solve problems
70. List important problem solving traits
71. Discuss ways to assess problem solving skills
72. Discuss the importance of negotiation
73. Discuss how to negotiate
74. Discuss how to identify new business opportunities
75. Discuss how to identify business opportunities within your business
76. Understand the meaning of entrepreneur
77. Describe the different types of entrepreneurs
78. List the characteristics of entrepreneurs
79. Recall entrepreneur success stories
80. Discuss the entrepreneurial process
81. Describe the entrepreneurship ecosystem
82. Discuss the government's role in the entrepreneurship ecosystem
83. Discuss the current entrepreneurship ecosystem in India
84. Understand the purpose of the Make in India campaign
85. Discuss the relationship between entrepreneurship and risk appetite
86. Discuss the relationship between entrepreneurship and resilience
87. Describe the characteristics of a resilient entrepreneur
88. Discuss how to deal with failure
89. Discuss how market research is carried out
90. Describe the 4 Ps of marketing
91. Discuss the importance of idea generation
92. Recall basic business terminology
93. Discuss the need for CRM
94. Discuss the benefits of CRM
95. Discuss the need for networking
96. Discuss the benefits of networking
97. Understand the importance of setting goals
98. Differentiate between short-term, medium-term and long-term goals
99. Discuss how to write a business plan
100. Explain the financial planning process
101. Discuss ways to manage your risk
102. Describe the procedure and formalities for applying for bank finance



## UNIT 9.1: Personal Strengths & Value Systems

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Understand the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Understand motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss how to maintain a positive attitude
15. Discuss the role of attitude in self-analysis
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management

## Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

## Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Personal Strengths and value systems.

## Say

- Tell the participants about the Health, Habits and Hygiene. What is Health? As per the World Health Organization (WHO), health is a “State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.”

## Elaborate

Explain – This means being healthy does not simply mean not being unhealthy – it also means you need to be at peace emotionally, and feel fit physically. For example, you cannot say you are healthy simply because you do not have any physical ailments like a cold or cough. You also need to think about whether you are feeling calm, relaxed and happy.

### Common Health Issues

Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- Cough, Cold, Sore Throat
- Difficulty Sleeping
- Obesity

## Say

- Give participants some tips to prevent health issues.

## Elaborate

Explain – Taking measures to prevent ill health is always better than curing a disease or sickness. You can stay healthy by:

- Eating healthy foods like fruits, vegetables and nuts
- Cutting back on unhealthy and sugary foods
- Drinking enough water everyday
- Not smoking or drinking alcohol
- Exercising for at least 30 minutes a day, 4-5 times a week
- Taking vaccinations when required
- Practicing yoga exercises and meditation

How many of these health standards do you follow? Tick the ones that apply to you.

- Get minimum 7-8 hours of sleep every night.
- Avoid checking email first thing in the morning and right before you go to bed at night.
- Don't skip meals – eat regular meals at correct meal times.
- Read a little bit every single day.
- Eat more home cooked food than junk food
- Stand more than you sit.
- Drink a glass of water first thing in the morning and have at least 8 glasses of water through the day.
- Go to the doctor and dentist for regular checkups.
- Exercise for 30 minutes at least 5 days a week.
- Avoid consuming lots of aerated beverages.

## Say

- Tell the participants what is hygiene. As per the World Health Organization (WHO), “Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases.” In other words, hygiene means ensuring that you do whatever is required to keep your surroundings clean, so that you reduce the chances of spreading germs and diseases.

## Elaborate

Explain – For instance, think about the kitchen in your home. Good hygiene means ensuring that the kitchen is always spick and span, the food is put away, dishes are washed and dustbins are not overflowing with garbage. Doing all this will reduce the chances of attracting pests like rats or cockroaches, and prevent the growth of fungus and other bacteria, which could spread disease.

How many of these health standards do you follow? Tick the ones that apply to you.

- Have a bath or shower every day with soap – and wash your hair with shampoo 2-3 times a week.
- Wear a fresh pair of clean undergarments every day.
- Brush your teeth in the morning and before going to bed.
- Cut your fingernails and toenails regularly.
- Wash your hands with soap after going to the toilet.
- Use an anti-perspirant deodorant on your underarms if you sweat a lot.
- Wash your hands with soap before cooking or eating.
- Stay home when you are sick, so other people don't catch what you have.
- Wash dirty clothes with laundry soap before wearing them again.
- Cover your nose with a tissue/your hand when coughing or sneezing.

See how healthy and hygienic you are, by giving yourself 1 point for every ticked statement! Then take a look at what your score means.

### Your Score

- 0-7/20: You need to work a lot harder to stay fit and fine! Make it a point to practice good habits daily and see how much better you feel!
- 7-14/20: Not bad, but there is scope for improvement! Try and add a few more good habits to your daily routine.
- 14-20/20: Great job! Keep up the good work! Your body and mind thank you.

## Say

- Tell the participants about the Swachh Bharat Abhiyan. The 'Swachh Bharat Abhiyan' (Clean India Mission) launched by Prime Minister Shri Narendra Modi on 2nd October 2014, believes in doing exactly this. The aim of this mission is to clean the streets and roads of India and raise the overall level of cleanliness. Currently this mission covers 4,041 cities and towns across the country. Millions of our people have taken the pledge for a clean India. You should take the pledge too, and do everything possible to keep our country clean!
- Also tell the participants about the habits.

## Elaborate

Explain – A habit is a behaviour that is repeated frequently. All of us have good habits and bad habits. Keep in mind the phrase by John Dryden: “We first make our habits, and then our habits make us.” This is why it is so important that you make good habits a way of life, and consciously avoid practicing bad habits.

Some good habits that you should make part of your daily routine are:

- Always having a positive attitude
- Making exercise a part of your daily routine
- Reading motivational and inspirational stories
- Smiling! Make it a habit to smile as often as possible
- Making time for family and friends
- Going to bed early and waking up early

Some bad habits that you should quit immediately are:

- Skipping breakfast
- Snacking frequently even when you are not hungry
- Eating too much fattening and sugary food
- Smoking, drinking alcohol and doing drugs
- Spending more money than you can afford
- Worrying about unimportant issues
- Staying up late and waking up late

## Do

Give participants some safety tips to design a safe workplace. Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Use ergonomically designed furniture and equipment to avoid stooping and twisting
- Provide mechanical aids to avoid lifting or carrying heavy objects
- Have protective equipment on hand for hazardous jobs
- Designate emergency exits and ensure they are easily accessible
- Set down health codes and ensure they are implemented
- Follow the practice of regular safety inspections in and around the workplace
- Ensure regular building inspections are conducted
- Get expert advice on workplace safety and follow it

## Say

- Tell the participants about the Negotiable Employee Safety Habits.

## Elaborate

Tell them – Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Immediately report unsafe conditions to a supervisor
- Recognize and report safety hazards that could lead to slips, trips and falls
- Report all injuries and accidents to a supervisor
- Wear the correct protective equipment when required
- Learn how to correctly use equipment provided for safety purposes
- Be aware of and avoid actions that could endanger other people
- Take rest breaks during the day and some time off from work during the week

## Say

- Tell the participants about the Self Analysis. To truly achieve your full potential, you need to take a deep look inside yourself and find out what kind of person you really are. This attempt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to identify areas within yourself that need to be further developed, changed or eliminated.
- Tell the participants about the motivation. Very simply put, motivation is your reason for acting or behaving in a certain manner. It is important to understand that not everyone is motivated by the same desires – people are motivated by many, many different things. We can understand this better by looking at Maslow's Hierarchy of Needs.
- Also tell the participants about the Maslow's Hierarchy of needs.

## Elaborate

Tell them – Famous American psychologist Abraham Maslow wanted to understand what motivates people. He believed that people have five types of needs, ranging from very basic needs (called physiological needs) to more important needs that are required for self-growth (called self-actualization needs). Between the physiological and self-actualization needs are three other needs – safety needs, belongingness and love needs, and esteem needs. These needs are usually shown as a pyramid with five levels and are known as Maslow's Hierarchy of Needs.

As you can see from the pyramid, the lowest level depicts the most basic needs. Maslow believed that our behaviour is motivated by our basic needs, until those needs are met. Once they are fulfilled, we move to the next level and are motivated by the next level of needs. Let's understand this better with an example:

“Rupa comes from a very poor family. She never has enough food, water, warmth or rest. According to Maslow, until Rupa is sure that she will get these basic needs, she will not even think about the next level of needs – her safety needs. But, once Rupa is confident that her basic needs will be met, she will move to the next level, and her behaviour will then be motivated by her need for security and safety. Once these new needs are met, Rupa will once again move to the next level, and be motivated by her need for relationships and friends. Once this need is satisfied, Rupa will then focus on the fourth level of needs – her esteem needs, after which she will move up to the fifth and last level of needs – the desire to achieve her full potential.”

## Say

- Tell the participants about the Achievements Motivation. We now know that people are motivated by basic, psychological and self-fulfillment needs. However, certain people are also motivated by the achievement of highly challenging accomplishments. This is known as Achievement Motivation, or 'need for achievement'.

## Elaborate

Tell them – The level of motivation achievement in a person differs from individual to individual. It is important that entrepreneurs have a high level of achievement motivation – a deep desire to accomplish something important and unique. It is equally important that they hire people who are also highly motivated by challenges and success.

### **Characteristics of Entrepreneurs with Achievement Motivation**

- Entrepreneurs with achievement motivation can be described as follows:
- Unafraid to take risks for personal accomplishment
- Love being challenged Future-oriented Flexible and adaptive
- Value negative feedback more than positive feedback
- Very persistent when it comes to achieving goals
- Extremely courageous
- Highly creative and innovative
- Restless - constantly looking to achieve more
- Feel personally responsible for solving problems

### **Think about it:**

- How many of these traits do you have?
- Can you think of entrepreneurs who display these traits?

## Say

- Tell the participants how to cultivate a positive attitude. The good news is attitude is a choice. So it is possible to improve, control and change our attitude, if we decide we want to!

## Elaborate

Tell them – The following tips help foster a positive mindset:

- Remember that you control your attitude, not the other way around
- Devote at least 15 minutes a day towards reading, watching or listening to something positive
- Avoid negative people who only complain and stop complaining yourself
- Expand your vocabulary with positive words and delete negative phrases from your mind
- Be appreciative and focus on what's good in yourself, in your life, and in others
- Stop thinking of yourself as a victim and start being proactive
- Imagine yourself succeeding and achieving your goals

## Say

- Tell the participants about the attitude. Now that we understand why motivation is so important for self-analysis, let's look at the role our attitude plays in better understanding ourselves. Attitude can be described as your tendency (positive or negative), to think and feel about someone or something

## Elaborate

Tell them – Attitude is the foundation for success in every aspect of life. Our attitude can be our best friend or our worst enemy. In other words:

***“The only disability in life is a bad attitude.”***

When you start a business, you are sure to encounter a wide variety of emotions, from difficult times and failures to good times and successes. Your attitude is what will see you through the tough times and guide you towards success. Attitude is also infectious. It affects everyone around you, from your customers to your employees to your investors. A positive attitude helps build confidence in the workplace while a negative attitude is likely to result in the demotivation of your people.



## Say

- Tell the participants about the Honesty and Work Ethics. Honesty is the quality of being fair and truthful. It means speaking and acting in a manner that inspires trust.

## Elaborate

Tell them – A person who is described as honest is seen as truthful and sincere, and as someone who isn't deceitful or devious and doesn't steal or cheat. There are two dimensions of honesty – one is honesty in communication and the other is honesty in conduct. Honesty is an extremely important trait because it results in peace of mind and builds relationships that are based on trust. Being dishonest, on the other hand, results in anxiety and leads to relationships full of distrust and conflict.

## Say

- Tell the participants about the Qualities of Honesty People.

## Elaborate

Tell them – Honest individuals have certain distinct characteristics. Some common qualities among honest people are:

- They don't worry about what others think of them. They believe in being themselves – they don't bother about whether they are liked or disliked for their personalities.
- They stand up for their beliefs. They won't think twice about giving their honest opinion, even if they are aware that their point of view lies with the minority.
- They are thick skinned. This means they are not affected by others judging them harshly for their honest opinions.
- They forge trusting, meaningful and healthy friendships. Honest people usually surround themselves with honest friends. They have faith that their friends will be truthful and upfront with them at all times.

They are trusted by their peers. They are seen as people who can be counted on for truthful and objective feedback and advice.

- **Honesty and employees:** When entrepreneurs build honest relationships with their employees, it leads to more transparency in the workplace, which results in higher work performance and better results.
- **Honesty and investors:** For entrepreneurs, being honest with investors means not only sharing strengths but also candidly disclosing current and potential weaknesses, problem areas and solution strategies. Keep

in mind that investors have a lot of experience with startups and are aware that all new companies have problems. Claiming that everything is perfectly fine and running smoothly is a red flag for most investors.

- **Honesty with oneself:** The consequences of being dishonest with oneself can lead to dire results, especially in the case of entrepreneurs. For entrepreneurs to succeed, it is critical that they remain realistic about their situation at all times, and accurately judge every aspect of their enterprise for what it truly is.

### What are Work Ethics?

Being ethical in the workplace means displaying values like honesty, integrity and respect in all your decisions and communications. It means not displaying negative qualities like lying, cheating and stealing. Workplace ethics play a big role in the profitability of a company. It is as crucial to an enterprise as high morale and teamwork. This is why most companies lay down specific workplace ethic guidelines that must compulsorily be followed by their employees. These guidelines are typically outlined in a company's employee handbook.

## Say

- Tell the participants about the Elements of Work Ethics.

## Elaborate

Tell them – An entrepreneur must display strong work ethics, as well as hire only those individuals who believe in and display the same level of ethical behavior in the workplace. Some elements of a strong work ethic are:

- **Professionalism:** This involves everything from how you present yourself in a corporate setting to the manner in which you treat others in the workplace.
- **Respectfulness:** This means remaining poised and diplomatic regardless of how stressful or volatile a situation is.
- **Dependability:** This means always keeping your word, whether it's arriving on time for a meeting or delivering work on time.
- **Dedication:** This means refusing to quit until the designated work is done, and completing the work at the highest possible level of excellence.
- **Determination:** This means embracing obstacles as challenges rather than letting them stop you, and pushing ahead with purpose and resilience to get the desired results.
- **Accountability:** This means taking responsibility for your actions and the consequences of your actions, and not making excuses for your mistakes.
- **Humility:** This means acknowledging everyone's efforts and hard work, and sharing the credit for accomplishments.

## Say

- Tell the participants how to foster a good work ethic. As an entrepreneur, it is important that you clearly define the kind of behavior that you expect from each and every team member in the workplace.

## Elaborate

Tell them – You should make it clear that you expect employees to display positive work ethics like:

- **Honesty:** All work assigned to a person should be done with complete honesty, without any deceit or lies.
- **Good attitude:** All team members should be optimistic, energetic, and positive.
- **Reliability:** Employees should show up where they are supposed to be, when they are supposed to be there.
- **Good work habits:** Employees should always be well groomed, never use inappropriate language, conduct themselves professionally at all times, etc.
- **Initiative:** Doing the bare minimum is not enough. Every team member needs to be proactive and show initiative.
- **Trustworthiness:** Trust is non-negotiable. If an employee cannot be trusted, it's time to let that employee go.
- **Respect:** Employees need to respect the company, the law, their work, their colleagues and themselves.
- **Integrity:** Each and every team member should be completely ethical and must display above board behaviour at all times.
- **Efficiency:** Efficient employees help a company grow while inefficient employees result in a waste of time and resources.

## Say

- Tell the participants about the creativity and innovation.

## Elaborate

### What is Creativity?

Creativity means thinking outside the box. It means viewing things in new ways or from different perspectives, and then converting these ideas into reality. Creativity involves two parts: thinking and producing. Simply having an idea makes you imaginative, not creative. However, having an idea and acting on it makes you creative.

### Characteristics of Highly Creative People

Some characteristics of creative people are:

- They are imaginative and playful
- They see issues from different angles
- They notice small details
- They have very little tolerance for boredom
- They detest rules and routine
- They love to daydream
- They are very curious

### What is Innovation?

There are many different definitions of innovation. In simple terms, innovation means turning an idea into a solution that adds value. It can also mean adding value by implementing a new product, service or process, or significantly improving on an existing product, service or process.

### Characteristics of Highly Innovative People

Some characteristics of highly innovative people are:

- They embrace doing things differently
- They don't believe in taking shortcuts
- They are not afraid to be unconventional
- They are highly proactive and persistent
- They are organized, cautious and risk-averse

## Say

- Tell the participants about the Time Management. Time management is the process organizing your time, and deciding how to allocate your time between different activities. Good time management is the difference between working smart (getting more done in less time) and working hard (working for more time to get more done).

## Elaborate

Tell them – Effective time management leads to an efficient work output, even when you are faced with tight deadlines and high pressure situations. On the other hand, not managing your time effectively results in inefficient output and increases stress and anxiety.

### Benefits of Time Management

Time management can lead to huge benefits like:

- Greater productivity

- Higher efficiency
- Better professional reputation
- Reduced stress
- Higher chances for career advancement
- Greater opportunities to achieve goals

Not managing time effectively can result in undesirable consequences like:

- Missing deadlines
- Inefficient work output
- Substandard work quality
- Poor professional reputation
- Stalled career
- Increase in stress and anxiety

## Do

Discuss with the participants about the Traits of effective Time Managers. Some traits of effective time managers are:

- They begin projects early They set daily objectives
- They modify plans if required, to achieve better results
- They are flexible and open-minded
- They inform people in advance if their help will be required
- They know how to say no
- They break tasks into steps with specific deadlines
- They continually review long term goals
- They think of alternate solutions if and when required
- They ask for help when required They create backup plans

## Say

- Tell the participants about the effective time management techniques.

## Elaborate

Tell them – You can manage your time better by putting into practice certain time management techniques. Some helpful tips are:

- Plan out your day as well as plan for interruptions. Give yourself at least 30 minutes to figure out your time plan. In your plan, schedule some time for interruptions.
- Put up a “Do Not Disturb” sign when you absolutely have to complete a certain amount of work.
- Close your mind to all distractions. Train yourself to ignore ringing phones, don’t reply to chat messages and disconnect from social media sites.
- Delegate your work. This will not only help your work get done faster, but will also show you the unique skills and abilities of those around you.
- Stop procrastinating. Remind yourself that procrastination typically arises due to the fear of failure or the belief that you cannot do things as perfectly as you wish to do them.
- Prioritize. List each task to be completed in order of its urgency or importance level. Then focus on completing each task, one by one.
- Maintain a log of your work activities. Analyze the log to help you understand how efficient you are, and how much time is wasted every day.
- Create time management goals to reduce time wastage.

## Say

- Now tell the participants about the Anger Management.

## Elaborate

Tell them – Anger management is the process of:

- Learning to recognize the signs that you, or someone else, is becoming angry
- Taking the best course of action to calm down the situation in a positive way Anger management does not mean suppressing anger.

### Importance of Anger Management

Anger is a perfectly normal human emotion. In fact, when managed the right way, anger can be considered a healthy emotion. However, if it is not kept in check, anger can make us act inappropriately and can lead to us saying or doing things that we will likely later regret.

### Extreme anger can:

- **Hurt you physically:** It leads to heart disease, diabetes, a weakened immune system, insomnia, and high blood pressure.
- **Hurt you mentally:** It can cloud your thinking and lead to stress, depression and mental health issues.

- Hurt your career: It can result in alienating your colleagues, bosses, clients and lead to the loss of respect.
- **Hurt your relationships:** It makes it hard for your family and friends to trust you, be honest with you and feel comfortable around you.

This is why anger management, or managing anger appropriately, is so important.

## Say

- Tell the participants about the Anger Management Strategies.

## Elaborate

Tell them – Here are some strategies that can help you control your anger:

Strategy 1: Relaxation

Strategy 2: Cognitive Restructuring

Strategy 3: Problem Solving

Strategy 4: Better Communication

Strategy 5: Changing Your Environment

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 321 and explain trainees' the concept.

## Say

- Tell the participants about the Stress Management. We say we are 'stressed' when we feel overloaded and unsure of our ability to deal with the pressures placed on us. Anything that challenges or threatens our well-being can be defined as a stress.

## Elaborate

Tell them – It is important to note that stress can be good and bad. While good stress keeps us going, negative stress undermines our mental and physical health. This is why it is so important to manage negative stress effectively.

### Causes of Stress

Stress can be caused by internal and external factors.

Internal causes of stress:

- Constant worry

- Rigid thinking
- Unrealistic expectations
- Pessimism
- Negative self-talk
- All in or all out attitude

External causes of stress:

- Major life changes
- Difficulties with relationships
- Having too much to do
- Difficulties at work or in school
- Financial difficulties
- Worrying about one’s children and/or family

**Say** 

- Tell the participants about the Symptoms of Stress.

**Elaborate** 

Tell them – Stress can manifest itself in numerous ways. Take a look at the cognitive, emotional, physical and behavioral symptoms of stress.

Cognitive Symptoms	Emotional Symptoms
<ul style="list-style-type: none"> <li>• Memory problems</li> <li>• Concentration issues</li> <li>• Lack of judgement</li> <li>• Pessimism</li> <li>• Anxiety</li> <li>• Constant worrying</li> </ul>	<ul style="list-style-type: none"> <li>• Depression</li> <li>• Agitation</li> <li>• Irritability</li> <li>• Loneliness</li> <li>• Anxiety</li> <li>• Anger</li> </ul>
Physical Symptoms	Behavioral Symptoms
<p>Aches and pain</p> <p>Diarrhea or constipation</p> <p>Nausea</p> <p>Dizziness</p> <p>Chest pain and/or rapid heartbeat</p> <p>Frequent cold or flu like feelings</p>	<p>Increase or decrease in appetite</p> <p>Over sleeping or not sleeping enough</p> <p>Withdrawing socially</p> <p>Ignoring responsibilities</p> <p>Consumption of alcohol or cigarettes</p> <p>Nervous habits like nail biting, pacing etc.</p>



**Do** 

Give participants Tips for managing Stress. The following tips can help you manage your stress better:

- Note down the different ways in which you can handle the various sources of your stress.
- Remember that you cannot control everything, but you can control how you respond.
- Discuss your feelings, opinions and beliefs rather than reacting angrily, defensively or passively.
- Practice relaxation techniques like meditation, yoga or tai chi when you start feeling stressed.
- Devote a part of your day towards exercise.
- Eat healthy foods like fruits and vegetables. Avoid unhealthy foods especially those containing large amounts of sugar.
- Plan your day so that you can manage your time better, with less stress.
- Say no to people and things when required.
- Schedule time to pursue your hobbies and interests.
- Ensure you get at least 7-8 hours of sleep.
- Reduce your caffeine intake.
- Increase the time spent with family and friends.

**Notes for Facilitation** 

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

**Activity** 

- Divide the class into two equal groups.
- Tell the participants they have to give a presentation on Work Ethics and Innovation.
- Tell them they would be given a time of 20 minute for preparation. The time for presentation for each group should not exceed 20 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Presentation on work ethics and innovation	2 Hours	• Charts and markers

## UNIT 9.2: Digital Literacy: A Recap

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Identify the basic parts of a computer
2. Identify the basic parts of a keyboard
3. Recall basic computer terminology
4. Recall basic computer terminology
5. Recall the functions of basic computer keys
6. Discuss the main applications of MS Office
7. Discuss the benefits of Microsoft Outlook
8. Discuss the different types of e-commerce
9. List the benefits of e-commerce for retailers and customers
10. Discuss how the Digital India campaign will help boost e-commerce in India
11. Describe how you will sell a product or service on an e-commerce platform

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Digital Literacy.

### Say

- Tell the participants about the basic parts of a Computer.

## Elaborate

- **Central Processing Unit (CPU):** The brain of the computer. It interprets and carries out program instructions.
- **Hard Drive:** A device that stores large amounts of data.
- **Monitor:** The device that contains the computer screen where the information is visually displayed.
- **Desktop:** The first screen displayed after the operating system loads.
- **Background:** The image that fills the background of the desktop.
- **Mouse:** A hand-held device used to point to items on the monitor.
- **Speakers:** Devices that enable you to hear sound from the computer.
- **Printer:** A device that converts output from a computer into printed paper documents.
- **Icon:** A small picture or image that visually represents something on your computer.
- **Cursor:** An arrow which indicates where you are positioned on the screen.
- **Program Menu:** A list of programs on your computer that can be accessed from the Start menu.
- **Taskbar:** The horizontal bar at the bottom of the computer screen that lists applications that are currently in use.
- **Recycle Bin:** A temporary storage for deleted files.

## Do

Discuss with the participants about the basic internet terms.

- **The Internet:** A vast, international collection of computer networks that transfers information.
- **The World Wide Web:** A system that lets you access information on the Internet.
- **Website:** A location on the World Wide Web (and Internet) that contains information about a specific topic.
- **Homepage:** Provides information about a website and directs you to other pages on that website.
- **Link/Hyperlink:** A highlighted or underlined icon, graphic, or text that takes you to another file or object.
- **Web Address/URL:** The address for a website.
- **Address Box:** A box in the browser window where you can type in a web address.

## Say

- Tell the participants about the basic computer keys.
  - » Arrow Keys: Press these keys to move your cursor.
  - » Space bar: Adds a space.
  - » Enter/Return: Moves your cursor to a new line.
  - » Shift: Press this key if you want to type a capital letter or the upper symbol of a key.

- » Caps Lock: Press this key if you want all the letters you type to be capital letters. Press it again to revert back to typing lowercase letters.
- » Backspace: Deletes everything to the left of your cursor.
- Also tell the participants about the MS office and Email.

## Elaborate

Tell them – MS Office or Microsoft Office is a suite of computer programs developed by Microsoft. Although meant for all users, it offers different versions that cater specifically to students, home users and business users. All the programs are compatible with both, Windows and Macintosh.

### Most Popular Office Products

Some of the most popular and universally used MS Office applications are:

1. **Microsoft Word:** Allows users to type text and add images to a document.
2. **Microsoft Excel:** Allows users to enter data into a spreadsheet and create calculations and graphs.
3. **Microsoft PowerPoint:** Allows users to add text, pictures and media and create slideshows and presentations.
4. **Microsoft Outlook:** Allows users to send and receive email.
5. **Microsoft OneNote:** Allows users to make drawings and notes with the feel of a pen on paper.
6. **Microsoft Access:** Allows users to store data over many tables.

### Why Choose Microsoft Outlook

A popular email management choice especially in the workplace, Microsoft Outlook also includes an address book, notebook, web browser and calendar. Some major benefits of this program are:

- Integrated search function: You can use keywords to search for data across all Outlook programs.
- Enhanced security: Your email is safe from hackers, junk mail and phishing website email.
- Email syncing: Sync your mail with your calendar, contact list, notes in One Note and...your phone!
- Offline access to email: No Internet? No problem! Write emails offline and send them when you're connected again.

## Say

- Tell the participants about the E-Commerce. E-commerce is the buying or selling of goods and services, or the transmitting of money or data, electronically on the internet. E-Commerce is the short form for "electronic commerce."

## Elaborate

Tell them – Followings are the examples of E-Commerce:

- Online shopping Online auctions
- Online ticketing
- Electronic payments
- Internet banking

### Types of E-Commerce

E-commerce can be classified based on the types of participants in the transaction. The main types of e-commerce are:

- **Business to Business (B2B):** Both the transacting parties are businesses.
- **Business to Consumer (B2C):** Businesses sell electronically to end-consumers.
- **Consumer to Consumer (C2C):** Consumers come together to buy, sell or trade items to other consumers.
- **Consumer-to-Business (C2B):** Consumers make products or services available for purchase to companies looking for exactly those services or products.
- **Business-to-Administration (B2A):** Online transactions conducted between companies and public administration.
- **Consumer-to-Administration (C2A):** Online transactions conducted between individuals and public

The e-commerce business provides some benefits for retailers and customers.

### Benefits for retailers:

- Establishes an online presence
- Reduces operational costs by removing overhead costs
- Increases brand awareness through the use of good keywords
- Increases sales by removing geographical and time constraints

### Benefits for customers:

- Offers a wider range of choice than any physical store
- Enables goods and services to be purchased from remote locations
- Enables consumers to perform price comparisons

## Do

- Discuss with the participants about the Digital India Campaign. Prime Minister Narendra Modi launched the Digital India campaign in 2015, with the objective of offering every citizen of India access to digital services, knowledge and information. The campaign aims to improve the country's online infrastructure and increase internet connectivity, thus boosting the e-commerce industry.
- Currently, the majority of online transactions come from tier 2 and tier 3 cities. Once the Digital India campaign is in place, the government will deliver services through mobile connectivity, which will help deliver internet to remote corners of the country. This will help the e-commerce market to enter India's tier 4 towns and rural areas.

**E-Commerce Activity**

Choose a product or service that you want to sell online. Write a brief note explaining how you will use existing e-commerce platforms, or create a new e-commerce platform, to sell your product or service.

**Notes for Facilitation** 

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

**Activity** 

- Divide the class into two equal groups.
- Tell the participants they have to demonstrate the steps of opening a Bank account and on online banking.
- Tell them they would be given a time of 20 minute for preparation. The time for presentation for each group should not exceed 20 minutes per group.
- Once the presentations are complete appreciate the efforts made by the group and summarize the highlights of the activity.

Skill Practice	Time	Resources
1. Demonstrate the process of opening a bank account and how to use online banking	2 Hours	<ul style="list-style-type: none"> <li>• Charts and markers</li> </ul>

## UNIT 9.3: Money Matters

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Differentiate between fixed and variable costs
6. Describe the main types of investment options
7. Describe the different types of insurance products
8. Describe the different types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfers

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Money Matters.

### Say

- Tell the participants about the Personal Finance. We all know that the future is unpredictable. You never know what will happen tomorrow, next week or next year. That's why saving money steadily through the years is so important.

## Elaborate

Tell them – Saving money will help improve your financial situation over time. But more importantly, knowing that you have money stashed away for an emergency will give you peace of mind. Saving money also opens the door to many more options and possibilities.

### Benefits of Saving

Inculcating the habit of saving leads to a vast number of benefits. Saving helps you:

- **Become financially independent:** When you have enough money saved up to feel secure you can start making your choices, from taking a vacation whenever you want, to switching careers or starting your own business.
- **Invest in yourself through education:** Through saving, you can earn enough to pay up for courses that will add to your professional experience and ultimately result in higher paying jobs.
- **Get out of debt:** Once you have saved enough as a reserve fund, you can use your savings to pay off debts like loans or bills that have accumulated over time.
- **Be prepared for surprise expenses:** Having money saved enables you to pay for unforeseen expenses like sudden car or house repairs, without feeling financially stressed.
- **Pay for emergencies:** Saving helps you deal with emergencies like sudden health issues or emergency trips without feeling financially burdened.
- **Afford large purchases and achieve major goals:** Saving diligently makes it possible to place down payments towards major purchases and goals, like buying a home or a car.
- **Retire:** The money you have saved over the years will keep you comfortable when you no longer have the income you would get from your job.

## Say

- Tell the participants about the Types of Bank Accounts.

## Elaborate

Tell them – In India, banks offer four main types of bank accounts. These are:

- Current Accounts
- Savings Accounts
- Recurring Deposit Accounts
- Fixed Deposit Accounts

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 330 and explain trainees' the concept.



## Say

- Tell the participants about Opening a Bank Accounts.

## Elaborate

Tell them – Opening a bank account is quite a simple process. Take a look at the steps to open an account of your own:

### Step 1: Fill in the Account Opening Form

This form requires you to provide the following information:

- Personal details (name, address, phone number, date of birth, gender, occupation, address)
- Method of receiving your account statement (hard copy/email)
- Details of your initial deposit (cash/cheque)
- Manner of operating your account (online/mobile banking/traditional via cheque, slip books) Ensure that you sign wherever required on the form.

### Step 2: Affix your Photograph

Stick a recent photograph of yourself in the allotted space on the form.

### Step 3: Provide your Know Your Customer (KYC) Details

KYC is a process that helps banks verify the identity and address of their customers. To open an account, every individual needs to submit certain approved documents with respect to photo identity (ID) and address proof. Some Officially Valid Documents (OVDs) are:

- Passport
- Driving License
- Voters' Identity Card
- PAN Card
- UIDAI (Aadhaar) Card

### Step 4: Submit All your Documents

Submit the completed Account Opening Form and KYC documents. Then wait until the forms are processed and your account has been opened!

## Say

- Tell the participants about Fixed and variable costs.

## Elaborate

Tell them – Fixed costs and variable costs together make up a company's total cost. These are the two types of costs that companies have to bear when producing goods and services. A fixed cost does not change with the volume of goods or services a company produces. It always remains the same. A variable cost, on the other hand, increases and decreases depending on the volume of goods and services produced. In other words, it varies with the amount produced.

### Differences between Fixed and Variable Costs

Let's take a look at some of the main differences between fixed and variable costs:

Criteria	Fixed Costs	Variable Costs
Meaning	A cost that stays the same, regardless of the output produced.	A cost that changes when the
Nature	Time related.	Volume related.
Incurred	Incurred irrespective of units being produced.	Incurred only when units are produced.
Unit cost	Inversely proportional to the number of units produced.	Remains the same, per unit.
Examples	Depreciation, rent, salary, insurance, tax etc.	Material consumed, wages, commission on sales, packing expenses, etc.

## Say

- Tell the participants about the investment, insurance and taxes.

## Elaborate

Tell them – Investment means that money is spent today with the aim of reaping financial gains at a future time. The main types of investment options are as follows:

- Bonds
- Stocks
- Small Savings
- Mutual Funds
- Fixed Deposits
- Real Estate
- Hedge Funds
- Private Equity
- Venture Capital

**Insurance**

There are two types of insurance:

1. Life Insurance
2. Non-Life or General Insurance.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 262 and explain trainees' the concept.

**Say** 

- Tell the participants about the online banking, NEFT, RTGS etc.

**Elaborate** 

Tell them – Internet or online banking allows account holders to access their account from a laptop at any location. In this way, instructions can be issued. To access an account, account holders simply need to use their unique customer ID number and password.

**Internet banking can be used to:**

- Find out an account balance
- Transfer amounts from one account to another
- Arrange for the issuance of cheques
- Instruct payments to be made
- Request for a cheque book
- Request for a statement of accounts
- Make a fixed deposit

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 335 and explain trainees' the concept.

**Notes for Facilitation** 

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## UNIT 9.4: Preparing for Employment & Self Employment

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Discuss the steps to prepare for an interview
2. Discuss the steps to create an effective Resume
3. Discuss the most frequently asked interview questions
4. Discuss how to answer the most frequently asked interview questions
5. Discuss basic workplace terminology

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Employment and Self Employment.

### Say

- Tell the participants about the Interview Preparation. The success of your getting the job that you want depends largely on how well your interview for that job goes. Therefore, before you go in for your interview, it is important that you prepare for it with a fair amount of research and planning.

## Elaborate

Tell them – Take a look at the steps to follow in order to be well prepared for an interview:

- Research the organization that you are having the interview with.
- Think about whether your skills and qualifications match the job requirements.
- Go through the most typical interview questions asked, and prepare your responses.
- Plan your attire for the interview.
- Ensure that you have packed everything that you may require during the interview.
- Remember the importance of non-verbal communication.
- Make a list of questions to end the interview with.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 269 and explain trainees' the concept.

## Say

- Tell the participants how to prepare an effective resume. A resume is a formal document that lists a candidate's work experience, education and skills. A good resume gives a potential employer enough information to believe the applicant is worth interviewing. That's why it is so important to create a résumé that is effective.

## Elaborate

Tell them – Take a look at the steps to create an effective resume:

**Step 1: Write the Address Section**

**Step 2: Add the Profile Summary Section**

**Step 3: Include Your Educational Qualifications**

**Step 4: List Your Technical Skills**

**Step 5: Insert Your Academic Project Experience**

**Step 6: List Your Strengths**

**Step 7: List Your Extracurricular Activities**

**Step 8: Write Your Personal Details**

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 340 and explain trainees' the concept.

## Say

- Tell the participants about the interview FAQs.

## Elaborate

Tell them – Take a look at some of the most frequently asked interview questions, and some helpful tips on how to answer them.

### Can you tell me a little about yourself?

Tips to answer:

- Don't provide your full employment or personal history.
- Offer 2-3 specific experiences that you feel are most valuable and relevant.
- Conclude with how those experiences have made you perfect for this specific role.

### How did you hear about the position?

Tips to answer:

- Tell the interviewer how you heard about the job – whether it was through a friend (name the friend), event or article (name them) or a job portal (say which one).
- Explain what excites you about the position and what in particular caught your eye about this role.

### What do you know about the company?

Tips to answer:

- Don't recite the company's About Us page.
- Show that you understand and care about the company's goals.
- Explain why you believe in the company's mission and values.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 342 and explain trainees' the concept.

## Say

- Tell the participants about the work readiness.

## Elaborate

Tell them – Every employee should be well versed in the following terms:

- **Annual leave:** Paid vacation leave given by employers to employees.
- **Background Check:** A method used by employers to verify the accuracy of the information provided by potential candidates.
- **Benefits:** A part of an employee's compensation package.
- **Breaks:** Short periods of rest taken by employees during working hours.
- **Compensation Package:** The combination of salary and benefits that an employer provides to his/her employees.

- **Compensatory Time (Comp Time):** Time off in lieu of pay.
- **Contract Employee:** An employee who works for one organization that sells said employee's services to another company, either on a project or time basis.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 344 and explain trainees' the concept.

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## UNIT 9.5: Understand Entrepreneurship

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Discuss the concept of entrepreneurship
2. Discuss the importance of entrepreneurship
3. Describe the characteristics of an entrepreneur
4. Describe the different types of enterprises
5. List the qualities of an effective leader
6. Discuss the benefits of effective leadership
7. List the traits of an effective team
8. Discuss the importance of listening effectively
9. Discuss how to listen effectively
10. Discuss the importance of speaking effectively
11. Discuss how to speak effectively
12. Discuss how to solve problems
13. List important problem solving traits
14. Discuss ways to assess problem solving skills
15. Discuss the importance of negotiation
16. Discuss how to negotiate
17. Discuss how to identify new business opportunities
18. Discuss how to identify business opportunities within your business
19. Understand the meaning of entrepreneur
20. Describe the different types of entrepreneurs
21. List the characteristics of entrepreneurs
22. Recall entrepreneur success stories
23. Discuss the entrepreneurial process
24. Describe the entrepreneurship ecosystem
25. Discuss the government's role in the entrepreneurship ecosystem
26. Discuss the current entrepreneurship ecosystem in India
27. Understand the purpose of the Make in India campaign
28. Discuss the relationship between entrepreneurship and risk appetite
29. Discuss the relationship between entrepreneurship and resilience
30. Describe the characteristics of a resilient entrepreneur
31. Discuss how to deal with failure



## Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

## Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Entrepreneurship.

## Say

- Tell the participants about the Entrepreneurship. Anyone who is determined to start a business, no matter what the risk, is an entrepreneur. Entrepreneurs run their own start-up, take responsibility for the financial risks and use creativity, innovation and vast reserves of self-motivation to achieve success.
- Tell the participants about the importance and characteristics of Entrepreneurship.

## Elaborate

Tell them – Entrepreneurship is very important for the following reasons:

- It results in the creation of new organizations
- It brings creativity into the marketplace
- It leads to improved standards of living
- It helps develop the economy of a country

### Characteristics of Entrepreneurs

All successful entrepreneurs have certain characteristics in common.

They are all:

- Extremely passionate about their work
- Confident in themselves
- Disciplined and dedicated

- Motivated and driven
- Highly creative
- Visionaries
- Open-minded
- Decisive

**Entrepreneurs also have a tendency to:**

- Have a high risk tolerance
- Thoroughly plan everything
- Manage their money wisely
- Make their customers their priority
- Understand their offering and their market in detail
- Ask for advice from experts when required
- Know when to cut their losses

**Say** 

- Tell the participants about the types of enterprises.

**Elaborate** 

Tell them – As an entrepreneur in India, you can own and run any of the following types of enterprises:

**Sole Proprietorship**

In a sole proprietorship, a single individual owns, manages and controls the enterprise. This type of business is the easiest to form with respect to legal formalities. The business and the owner have no separate legal existence. All profit belongs to the proprietor, as do all the losses- the liability of the entrepreneur is unlimited.

**Partnership**

A partnership firm is formed by two or more people. The owners of the enterprise are called partners. A partnership deed must be signed by all the partners. The firm and its partners have no separate legal existence. The profits are shared by the partners. With respect to losses, the liability of the partners is unlimited. A firm has a limited life span and must be dissolved when any one of the partners dies, retires, claims bankruptcy or goes insane.

**Limited Liability Partnership (LLP)**

In a Limited Liability Partnership or LLP, the partners of the firm enjoy perpetual existence as well as the advantage of limited liability. Each partner's liability is limited to their agreed contribution to the LLP. The partnership and its partners have a separate legal existence.

## Say

- Tell the participants about the Leadership and team Work. Leadership means setting an example for others to follow. Setting a good example means not asking someone to do something that you wouldn't willingly want to do yourself. Leadership is about figuring out what to do in order to win as a team, and as a company. Leaders believe in doing the right things.
- Also tell the participants about the Leadership qualities that all entrepreneurs need.

## Elaborate

Tell them – Building a successful enterprise is only possible if the entrepreneur in charge possesses excellent leadership qualities. Some critical leadership skills that every entrepreneur must have are:

- **Pragmatism:** This means having the ability to highlight all obstacles and challenges, in order to resolve issues and reduce risks.
- **Humility:** This means admitting to mistakes often and early, and being quick to take responsibility for your actions. Mistakes should be viewed as challenges to overcome, not opportunities to point blame.
- **Flexibility:** It is critical for a good leader to be very flexible and quickly adapt to change. It is equally critical to know when to adapt and when not to.
- **Authenticity:** This means showing both, your strengths and your weaknesses. It means being human and showing others that you are human.
- **Reinvention:** This means refreshing or changing your leadership style when necessary. To do this, it's important to learn where your leadership gaps lie and find out what resources are required to close them.
- **Awareness:** This means taking the time to recognize how others view you. It means understanding how your presence affects those around you.

## Say

- Tell the participants about the benefits of effective Leadership. Effective leadership results in numerous benefits. Great leadership leads to the leader successfully:
  - » Gaining the loyalty and commitment of the team members
  - » Motivating the team to work towards achieving the company's goals and objectives
  - » Building morale and instilling confidence in the team members
  - » Fostering mutual understanding and team-spirit among team members
  - » Convincing team members about the need to change when a situation requires adaptability
- Discuss with the participants about the teamwork and teams. Teamwork occurs when the people in a workplace combine their individual skills to pursue a common goal. Effective teams are made up of individuals who work together to achieve this common goal. A great team is one who holds themselves accountable for the end result.
- Also tell the participants about the importance of team work in entrepreneurial success.

## Elaborate

Tell them – For an entrepreneurial leader, building an effective team is critical to the success of a venture. An entrepreneur must ensure that the team he builds possesses certain crucial qualities, traits and characteristics. An effective team is one which has:

- **Unity of purpose:** All the team members should clearly understand and be equally committed to the purpose, vision and goals of the team.
- **Great communication skills:** Team members should have the ability to express their concerns, ask questions and use diagrams, and charts to convey complex information.
- **The ability to collaborate:** Every member should feel entitled to provide regular feedback on new ideas.
- **Initiative:** The team should consist of proactive individuals. The members should have the enthusiasm to come up with new ideas, improve existing ideas, and conduct their own research.
- **Visionary members:** The team should have the ability to anticipate problems and act on these potential problem before they turn into real problems.
- **Great adaptability skills:** The team must believe that change is a positive force. Change should be seen as the chance to improve and try new things.
- **Excellent organizational skills:** The team should have the ability to develop standard work processes, balance responsibilities, properly plan projects, and set in place methods to measure progress and ROI.

## Say

- Tell the participants about the communication skills. Listening is the ability to correctly receive and understand messages during the process of communication. Listening is critical for effective communication. Without effective listening skills, messages can easily be misunderstood. This results in a communication breakdown and can lead to the sender and the receiver of the message becoming frustrated or irritated.
- Also tell the participants how to listen effectively.

## Elaborate

Tell them – To listen effectively you should:

- Stop talking
- Stop interrupting
- Focus completely on what is being said
- Nod and use encouraging words and gestures
- Be open-minded
- Think about the speaker's perspective
- Be very, very patient

- Pay attention to the tone that is being used
- Pay attention to the speaker's gestures, facial expressions and eye movements
- Not try and rush the person
- Not let the speaker's mannerisms or habits irritate or distract you

### How to Listen Effectively

How successfully a message gets conveyed depends entirely on how effectively you are able to get it through. An effective speaker is one who enunciates properly, pronounces words correctly, chooses the right words and speaks at a pace that is easily understandable. Besides this, the words spoken out loud need to match the gestures, tone and body language used.

What you say, and the tone in which you say it, results in numerous perceptions being formed. A person who speaks hesitantly may be perceived as having low self-esteem or lacking in knowledge of the discussed topic. Those with a quiet voice may very well be labelled as shy. And those who speak in commanding tones with high levels of clarity, are usually considered to be extremely confident. This makes speaking a very critical communication skill.

### Say

- Tell the participants how to speak effectively.

### Elaborate

Tell them – To speak effectively you should:

- Incorporate body language in your speech like eye contact, smiling, nodding, gesturing etc.
- Build a draft of your speech before actually making your speech.
- Ensure that all your emotions and feelings are under control.
- Pronounce your words distinctly with the correct pitch and intensity. Your speech should be crystal clear at all times.
- Use a pleasant and natural tone when speaking. Your audience should not feel like you are putting on an accent or being unnatural in any way.
- Use precise and specific words to drive your message home. Ambiguity should be avoided at all costs.
- Ensure that your speech has a logical flow.
- Be brief. Don't add any unnecessary information.
- Make a conscious effort to avoid irritating mannerisms like fidgeting, twitching etc.
- Choose your words carefully and use simple words that the majority of the audience will have no difficulty understanding.
- Use visual aids like slides or a whiteboard.

- Speak slowly so that your audience can easily understand what you're saying. However, be careful not to speak too slowly because this can come across as stiff, unprepared or even condescending.
- Remember to pause at the right moments

## Say

Tell the participants about the problem solving and negotiation skills. As per The Concise Oxford Dictionary (1995), a problem is, "A doubtful or difficult matter requiring a solution". All problems contain two elements:

- Goals
- Obstacles

The aim of problem solving is to recognize the obstacles and remove them in order to achieve the goals

- Also tell the participants how to solve the problems.

## Elaborate

Tell them – Solving a problem requires a level of rational thinking. Here are some logical steps to follow when faced with an issue:

- **Step 1:** Identify the problem
- **Step 2:** Study the problem in detail
- **Step 3:** List all possible solutions
- **Step 4:** Select the best solution
- **Step 5:** Implement the chosen solution
- **Step 6:** Check that the problem has really been solved

## Do

Discuss with the participants about the important traits for problem solving. Highly developed problem solving skills are critical for both, business owners and their employees. The following personality traits play a big role in how effectively problems are solved:

- Being open minded
- Asking the right questions
- Being proactive
- Not panicking

- Having a positive attitude
- Focusing on the right problem

## Say

- Tell the participants about the negotiation. Negotiation is a method used to settle differences. The aim of negotiation is to resolve differences through a compromise or agreement while avoiding disputes. Without negotiation, conflicts are likely to lead to resentment between people.

## Elaborate

Tell them – Good negotiation skills help satisfy both parties and go a long way towards developing strong relationships.

### Why Negotiate

Starting a business requires many, many negotiations. Some negotiations are small while others are critical enough to make or break a startup. Negotiation also plays a big role inside the workplace. As an entrepreneur, you need to know not only how to negotiate yourself, but also how to train employees in the art of negotiation.

### How to Negotiate

Take a look at some steps to help you negotiate:

- **Step 1:** Pre-Negotiation Preparation: Agree on where to meet to discuss the problem, decide who all will be present and set a time limit for the discussion.
- **Step 2:** Discuss the Problem: This involves asking questions, listening to the other side, putting your views forward and clarifying doubts.
- **Step 3:** Clarify the Objective: Ensure that both parties want to solve the same problem and reach the same goal.
- **Step 4:** Aim for a Win-Win Outcome: Try your best to be open minded when negotiating. Compromise and offer alternate solutions to reach an outcome where both parties win.
- **Step 5:** Clearly Define the Agreement: When an agreement has been reached, the details of the agreement should be crystal clear to both sides, with no scope for misunderstandings.
- **Step 6:** Implement the Agreed Upon Solution: Agree on a course of action to set the solution in motion.

## Say

- Now tell the participants about the Business opportunities Identification.

## Elaborate

Tell them – The ability to identify business opportunities is an essential characteristic of an entrepreneur.

### What is an Opportunity?

The word opportunity suggests a good chance or a favourable situation to do something offered by circumstances.

A business opportunity means a good or favourable change available to run a specific business in a given environment, at a given point of time.

### Common Questions Faced by Entrepreneurs

A critical question that all entrepreneurs face is how to go about finding the business opportunity that is right for them.

Some common questions that entrepreneurs constantly think about are:

- Should the new enterprise introduce a new product or service based on an unmet need?
- Should the new enterprise select an existing product or service from one market and offer it in another where it may not be available?
- Should the enterprise be based on a tried and tested formula that has worked elsewhere?

It is therefore extremely important that entrepreneurs must learn how to identify new and existing business opportunities and evaluate their chances of success.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 355 and explain trainees' the concept.

## Say

- Now tell the participants about the Entrepreneurship Support eco-system.

## Elaborate

Tell them – An entrepreneur is a person who

- Does not work for an employee
- Runs a small enterprise
- Assumes all the risks and rewards of the enterprise, idea, good or service

### Types of Entrepreneurs

There are four main types of entrepreneurs:

- The Traditional Entrepreneur
- The Growth Potential Entrepreneur
- The Project-Oriented Entrepreneur



- The Lifestyle Entrepreneur

### Characteristics of an Entrepreneur

- Successful entrepreneurs have the following characteristics
- They are highly motivated
- They are creative and persuasive
- They are mentally prepared to handle each and every task
- They have excellent business skills – they know how to evaluate their cash flow, sales and revenue
- They are willing to take great risks
- They are very proactive – this means they are willing to do the work themselves, rather than wait for someone else to do it
- They have a vision – they are able to see the big picture
- They are flexible and open-minded
- They are good at making decisions

## Do

Discuss with the participants about the Entrepreneur Success Stories.

### Dhiru Bhai Ambani

*Dhirubhai Ambani began his entrepreneurial career by selling “bhajias” to pilgrims in Mount Girnar on weekends. At 16, he moved to Yemen where he worked as a gas-station attendant, and as a clerk in an oil company. He returned to India with Rs. 50,000 and started a textile trading company. Reliance went on to become the first Indian company to raise money in global markets and the first Indian company to feature in Forbes 500 list.*

### Dr. Karsanbhai Patel

*Karsanbhai Patel made detergent powder in the backyard of his house. He sold his product door-to-door and offered a money back guarantee with every pack that was sold. He charged Rs. 3 per kg when the cheapest detergent at that time was Rs.13 per kg. Dr. Patel eventually started Nirma which became a whole new segment in the Indian domestic detergent market.*

## Say

- Now tell the participants about the Entrepreneurial Process.

## Elaborate

Tell them – Let's take a look at the stages of the entrepreneurial process.

- **Stage 1:** Idea Generation. The entrepreneurial process begins with an idea that has been thought of by the entrepreneur. The idea is a problem that has the potential to be solved.
- **Stage 2:** Germination or Recognition. In this stage a possible solution to the identified problem is thought of.
- **Stage 3:** Preparation or Rationalization. The problem is studied further and research is done to find out how others have tried to solve the same problem.
- **Stage 4:** Incubation or Fantasizing. This stage involves creative thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.
- **Stage 5:** Feasibility Study: The next step is the creation of a feasibility study to determine if the idea will make a profit and if it should be seen through.
- **Stage 6:** Illumination or Realization. This is when all uncertain areas suddenly become clear. The entrepreneur feels confident that his idea has merit.
- **Stage 7:** Verification or Validation. In this final stage, the idea is verified to see if it works and if it is useful.

Take a look at the diagram below to get a better idea of this process.

## Say

- Now tell the participants about the Entrepreneur. The entrepreneurship support ecosystem signifies the collective and complete nature of entrepreneurship. New companies emerge and flourish not only because of the courageous, visionary entrepreneurs who launch them, but they thrive as they are set in an environment or 'ecosystem' made of private and public participants.

## Elaborate

Tell them – These players nurture and sustain the new ventures, facilitating the entrepreneurs' efforts.

**An entrepreneurship ecosystem comprises of the following six domains:**

- **Favourable Culture:** This includes elements such as tolerance of risk and errors, valuable networking and positive social standing of the entrepreneur.
- **Facilitating Policies & Leadership:** This includes regulatory framework incentives and existence of public research institutes.
- **Financing Options:** Angel financing, venture capitalists and micro loans would be good examples of this.
- **Human Capital:** This refers to trained and untrained labour, entrepreneurs and entrepreneurship training programmes, etc.
- **Conducive Markets for Products & Services:** This refers to an existence or scope of existence of a market for the product/service.

- **Institutional & Infrastructural Support:** This includes legal and financing advisers, telecommunications, digital and transportation infrastructure, and entrepreneurship networking programmes.

These domains indicate whether there is a strong entrepreneurship support ecosystem and what actions should the government put in place to further encourage this ecosystem. The six domains and their various elements have been graphically depicted.

Every entrepreneurship support ecosystem is unique and all the elements of the ecosystem are interdependent. Although every region's entrepreneurship ecosystem can be broadly described by the above features, each ecosystem is the result of the hundred elements interacting in highly complex and particular ways.

Entrepreneurship ecosystems eventually become (largely) self-sustaining. When the six domains are resilient enough, they are mutually beneficial. At this point, government involvement can and should be significantly minimized. Public leaders do not need to invest a lot to sustain the ecosystem. It is imperative that the entrepreneurship ecosystem incentives are formulated to be self-liquidating, hence focusing on sustainability of the environment.

## Say

- Now tell the participants about the Government's role in the Entrepreneurship Ecosystem. Encouraging new ventures is a major focus for policymakers. Governments across the world are recognizing that new businesses flourish in distinctive types of supportive environments.

## Elaborate

Tell them – Policymakers should study the scenario and take into account the following points whilst they formulate policies and regulations that enable successful entrepreneurship support ecosystems.

- Policymakers should avoid regulations that discourage new entrants and work towards building efficient methods for business startups. Policies and regulations that favour existing, dominant firms over entrepreneurial ventures restrict competition and obstruct entry for new companies.
- Instead of developing policies conceptually intended to correct market failures, policymakers should interact with entrepreneurs and understand the challenges faced by them. The feedback should be used to develop policies that incite idea exploration, product development and increased rates of deal flow.
- Entrepreneurial supporters should create a database that enables identifying who the participants in the ecosystem are and how they are connected. These ecosystem maps are useful tools in developing engagement strategies.
- Disruptions are unavoidable in economic and social life. However, it's important to note that economic disruption gives rise to entrepreneurial opportunities. Architects of the entrepreneurship ecosystems (entrepreneurs, mentors, policymakers and consumers,) should anticipate these dips, thus capitalizing on the opportunities they create.

The need for effective strategies to enable local entrepreneurship support ecosystems is a practical one. Better understanding of the actual ecosystems provides a framework within which policy makers can ask relevant questions, envisage more efficient approaches, and assess ensuing outcomes.

## Say

- Now tell the participants about the Snapshot of the Entrepreneurship Ecosystem in India. Entrepreneurship has earned a newfound respect in India. Many Indians, with exposure to the world of business, who traditionally would have opted for a job, are setting up their own ventures. Many elements of the entrepreneurship ecosystem are beginning to come together. For example, increase in venture capitalists, government schemes and incubators, academia industry linkages, and emerging clusters and support to rural economy.

## Elaborate

Tell them – Policymakers should study the scenario and take into account the following points whilst they formulate policies and regulations that enable successful entrepreneurship support ecosystems.

- We need to review our attitude towards failures and accept them as learning experiences.
- We must encourage the educated to become entrepreneurs and provide students in schools and colleges with entrepreneurship skills.
- Universities, research labs and the government need to play the role of enablers in the entrepreneurship support ecosystem.
- Policymakers need to focus on reducing the obstacles such as corruption, red tape and bureaucracy.
- We need to improve our legal systems and court international venture capital firms and bring them to India.
- We must devise policies and methods to reach the secondary and tertiary towns in India, where people do not have access to the same resources available in the cities.

Today, there is a huge opportunity in this country to introduce innovative solutions that are capable of scaling up, and collaborating within the ecosystem as well as enriching it.

## Say

- Now tell the participants about the Make in India Campaign.

## Elaborate

Tell them – Every entrepreneur has certain needs. Some of their important needs are:

- To easily get loans
- To easily find investors
- To get tax exemptions
- To easily access resources and good infrastructure
- To enjoy a procedure that is free of hassles and is quick

- To be able to easily partner with other firms

The Make in India campaign, launched by Prime Minister Modi aims to satisfy all these needs of young, aspiring entrepreneurs. Its objective is to:

- Make investment easy
- Support new ideas
- Enhance skill development
- Safeguard the ideas of entrepreneurs
- Create state-of-the-art facilities for manufacturing goods

## Say

- Now tell the participants about the Risk Appetite and Resilience.

## Elaborate

### Entrepreneurship and Risk

Entrepreneurs are inherently risk takers. They are path-makers not path-takers. Unlike a normal, cautious person, an entrepreneur would not think twice about quitting his job (his sole income) and taking a risk on himself and his idea.

An entrepreneur is aware that while pursuing his dreams, assumptions can be proven wrong and unforeseen events may arise. He knows that after dealing with numerous problems, success is still not guaranteed. Entrepreneurship is synonymous with the ability to take risks. This ability, called risk-appetite, is an entrepreneurial trait that is partly genetic and partly acquired.

### What is Risk Appetite?

Risk appetite is defined as the extent to which a company is equipped to take risk, in order to achieve its objectives. Essentially, it refers to the balance, struck by the company, between possible profits and the hazards caused by changes in the environment (economic ecosystem, policies, etc.). Taking on more risk may lead to higher rewards but have a high probability of losses as well. However, being too conservative may go against the company as it can miss out on good opportunities to grow and reach their objectives.

The levels of risk appetite can be broadly categorized as “low”, “medium” and “high.” The company’s entrepreneur(s) have to evaluate all potential alternatives and select the option most likely to succeed. Companies have varying levels of risk appetites for different objectives. The levels depend on:

- The type of industry
- Market pressures
- Company objectives

For example, a startup with a revolutionary concept will have a very high risk appetite. The startup can afford short term failures before it achieves longer term success. This type of appetite will not remain constant and will be adjusted to account for the present circumstances of the company.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 363 and explain trainees' the concept.

## Say

- Now tell the participants about the Success and Failures. Understanding Successes and Failures in Entrepreneurship.

## Elaborate

Tell them – Shyam is a famous entrepreneur, known for his success story. But what most people don't know, is that Shyam failed numerous times before his enterprise became a success. Read his interview to get an idea of what entrepreneurship is really about, straight from an entrepreneur who has both, failed and succeed

**Interviewer:** Shyam, I have heard that entrepreneurs are great risk-takers who are never afraid of failing. Is this true?

**Shyam:** Ha ha, no of course it's not true! Most people believe that entrepreneurs need to be fearlessly enthusiastic. But the truth is, fear is a very normal and valid human reaction, especially when you are planning to start your own business! In fact, my biggest fear was the fear of failing. The reality is, entrepreneurs fail as much as they succeed. The trick is to not allow the fear of failing to stop you from going ahead with your plans. Remember, failures are lessons for future success!

**Interviewer:** What, according to you, is the reason that entrepreneurs fail?

**Shyam:** Well, there is no one single reason why entrepreneurs fail. An entrepreneur can fail due to numerous reasons. You could fail because you have allowed your fear of failure to defeat you. You could fail because you are unwilling to delegate (distribute) work. As the saying goes, "You can do anything, but not everything!" You could fail because you gave up too easily – maybe you were not persistent enough. You could fail because you were focusing your energy on small, insignificant tasks and ignoring the tasks that were most important. Other reasons for failing are partnering with the wrong people, not being able to sell your product to the right customers at the right time at the right price... and many more reasons!

**Interviewer:** As an entrepreneur, how do you feel failure should be looked at?

**Shyam:** I believe we should all look at failure as an asset, rather than as something negative. The way I see it, if you have an idea, you should try to make it work, even if there is a chance that you will fail. That's because not trying is failure right there, anyway! And failure is not the worst thing that can happen. I think having regrets because of not trying, and wondering 'what if' is far worse than trying and actually failing.

**Interviewer:** How did you feel when you failed for the first time?

**Shyam:** I was completely heartbroken! It was a very painful experience. But the good news is, you do recover from the failure. And with every subsequent failure, the recovery process gets a lot easier. That's because you start to see each failure more as a lesson that will eventually help you succeed, rather than as an obstacle that you cannot overcome. You will start to realize that failure has many benefits.

**Interviewer:** Can you tell us about some of the benefits of failing?

**Shyam:** One of the benefits that I have experienced personally from failing is that the failure made me see things in a new light. It gave me answers that I didn't have before. Failure can make you a lot stronger. It also helps keep your ego in control.

**Interviewer:** What advice would you give entrepreneurs who are about to start their own enterprises?

**Shyam:** I would tell them to do their research and ensure that their product is something that is actually wanted by customers. I'd tell them to pick their partners and employees very wisely and cautiously. I'd tell them that it's very important to be aggressive – push and market your product as aggressively as possible. I would warn them that starting an enterprise is very expensive and that they should be prepared for a situation where they run out of money.

I would tell them to create long term goals and put a plan in action to achieve that goal. I would tell them to build a product that is truly unique. Be very careful and ensure that you are not copying another startup. Lastly, I'd tell them that it's very important that they find the right investors.

**Interviewer:** That's some really helpful advice, Shyam! I'm sure this will help all entrepreneurs to be more prepared before they begin their journey! Thank you for all your insight!

## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.

## UNIT 9.6: Preparing to be an Entrepreneur

### Unit Objectives

**At the end of the unit, students will be able to:**

1. Discuss how market research is carried out
2. Describe the 4 Ps of marketing
3. Discuss the importance of idea generation
4. Recall basic business terminology
5. Discuss the need for CRM
6. Discuss the benefits of CRM
7. Discuss the need for networking
8. Discuss the benefits of networking
9. Understand the importance of setting goals
10. Differentiate between short-term, medium-term and long-term goals
11. Discuss how to write a business plan
12. Explain the financial planning process
13. Discuss ways to manage your risk
14. Describe the procedure and formalities for applying for bank finance
15. Discuss how to manage your own enterprise
16. List important questions that every entrepreneur should ask before starting an enterprise

### Resources to be Used

- Available objects such as black or white Board, chalk pieces or white board marker pens, duster.
- Pc with LCD Projector or Flip Chart.
- Participant Manual.
- Copies of Handouts.

### Do

- Greet and welcome the participants to the next session of the program.
- Before starting the session ask them do they have any doubts pertaining to the previous unit.
- Acknowledge their responses and clear their doubts if any.
- Tell them they will learn about Preparing to be an Entrepreneur.



## Say

- Tell the participants about the market study.

## Elaborate

### Understanding Market Research

Market research is the process of gathering, analyzing and interpreting market information on a product or service that is being sold in that market. It also includes information on:

- Past, present and prospective customers
- Customer characteristics and spending habits
- The location and needs of the target market
- The overall industry
- Relevant competitors

### Market research involves two types of data:

- Primary information. This is research collected by yourself or by someone hired by you.
- Secondary information. This is research that already exists and is out there for you to find and use.

### Primary research

Primary research can be of two types:

- **Exploratory:** This is open-ended and usually involves detailed, unstructured interviews.
- **Specific:** This is precise and involves structured, formal interviews. Conducting specific research is the more expensive than conducting exploratory research.

### Secondary research

Secondary research uses outside information. Some common secondary sources are:

- **Public sources:** These are usually free and have a lot of good information. Examples are government departments, business departments of public libraries etc.
- **Commercial sources:** These offer valuable information but usually require a fee to be paid. Examples are research and trade associations, banks and other financial institutions etc.
- **Educational institutions:** These offer a wealth of information. Examples are colleges, universities, technical.

## Say

- Tell the participants about the 4 Ps of marketing.

## Elaborate

Tell them –The 4 Ps of marketing are:

- Product,
- Price,
- Promotion and
- Place.

Let's look at each of these 4 Ps in detail.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 367 and explain trainees' the concept.

## Say

- Tell the participants about the Business entity concepts. If your aim is to start and run a business, it is crucial that you have a good understanding of basic business terms.

## Elaborate

Tell them – Every entrepreneur should be well versed in the following terms:

- Accounting: A systematic method of recording and reporting financial transactions.
- Accounts payable: Money owed by a company to its creditors.
- Accounts Receivable: The amount a company is owed by its clients.
- Assets: The value of everything a company owns and uses to conduct its business.
- Balance Sheet: A snapshot of a company's assets, liabilities and owner's equity at a given moment.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 369 and explain trainees' the concept.

## Say

- Tell the participants about the CRM. CRM stands for Customer Relationship Management. Originally the expression Customer Relationship Management meant managing one's relationship with customers. However, today it refers to IT systems and software designed to help companies manage their relationships.

## Elaborate

### The Need for CRM

The better a company can manage its relationships with its customers, the higher the chances of the company's success. For any entrepreneur, the ability to successfully retain existing customers and expand the enterprise is paramount. This is why IT systems that focus on addressing the problems of dealing with customers on a daily basis are becoming more and more in demand.

Customer needs change over time, and technology can make it easier to understand what customers really want. This insight helps companies to be more responsive to the needs of their customers. It enables them to modify their business operations when required, so that their customers are always served in the best manner possible. Simply put, CRM helps companies recognize the value of their clients and enables them to capitalize on improved customer relations.

### Benefits of CRM

CRM has a number of important benefits:

- It helps improve relations with existing customers which can lead to:
- Increased sales
- Identification of customer needs
- Cross-selling of products
- It results in better marketing of one's products or services
- It enhances customer satisfaction and retention
- It improves profitability by identifying and focusing on the most profitable customers

## Say

- Tell the participants about the Networking. In business, networking means leveraging your business and personal connections in order to bring in a regular supply of new business. This marketing method is effective as well as low cost. It is a great way to develop sales opportunities and contacts.

## Elaborate

Tell them – Networking can be based on referrals and introductions, or can take place via phone, email, and social and business networking websites.

### The Need for Networking

Networking is an essential personal skill for business people, but it is even more important for entrepreneurs. The process of networking has its roots in relationship building. Networking results in greater communication and a stronger presence in the entrepreneurial ecosystem. This helps build strong relationships with other entrepreneurs.

Business networking events held across the globe play a huge role in connecting like-minded entrepreneurs who share the same fundamental beliefs in communication, exchanging ideas and converting ideas into realities. Such networking events also play a crucial role in connecting entrepreneurs with potential investors. Entrepreneurs

may have vastly different experiences and backgrounds but they all have a common goal in mind – they all seek connection, inspiration, advice, opportunities and mentors. Networking offers them a platform to do just that.

#### Benefits of Networking

Networking offers numerous benefits for entrepreneurs. Some of the major benefits are:

- Getting high quality leads
- Increased business opportunities
- Good source of relevant connections
- Advice from like-minded entrepreneurs
- Gaining visibility and raising your profile
- Meeting positive and enthusiastic people
- Increased self-confidence
- Satisfaction from helping others
- Building strong and lasting friendships

### Say

- Tell the participants about the Business Plans. Setting goals is important because it gives you long-term vision and short-term motivation. Goals can be short term, medium term and long term.

### Elaborate

Tell them – Short-Term Goals

- These are specific goals for the immediate future. Example: Repairing a machine that has failed. Medium-Term Goals
- These goals are built on your short term goals.
- They do not need to be as specific as your short term goals.

Example: Arranging for a service contract to ensure that your machines don't fail again.

Long-Term Goals

These goals require time and planning. They usually take a year or more to achieve.

Example: Planning your expenses so you can buy new machinery

#### Why Create a Business Plan

A business plan is a tool for understanding how your business is put together. It can be used to monitor progress, foster accountability and control the fate of the business. It usually offers a 3-5 year projection and outlines the plan that the company intends to follow to grow its revenues. A business plan is also a very important tool for getting the interest of key employees or future investors. A business plan typically comprises of eight elements.

## Say

- Tell the participants about the Elements of a Business Plans. The executive summary follows the title page. The summary should clearly state your desires as the business owner in a short and businesslike way. It is an overview of your business and your plans. Ideally this should not be more than 1-2 pages.

## Elaborate

Tell them – Your Executive Summary should include:

- The Mission Statement: Explain what your business is all about.
- Example: Nike’s Mission Statement
- Nike’s mission statement is “To bring inspiration and innovation to every athlete in the world.”
- Company Information: Provide information like when your business was formed, the names and roles of the founders, the number of employees, your business location(s) etc.
- Growth Highlights: Mention examples of company growth. Use graphs and charts where possible.
- Your Products/Services: Describe the products or services provided.
- Financial Information: Provide details on current bank and investors.
- Summarize future plans: Describe where you see your business in the future.

**Trainer’s Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 372 and explain trainees’ the concept.

## Say

- Tell the participants what Information Should Entrepreneurs Offer Banks for Funding. When approaching a bank, entrepreneurs must have a clear idea of the different criteria that banks use to screen, rate and process loan applications. Entrepreneurs must also be aware of the importance of providing banks with accurate and correct information.

## Elaborate

Tell them – It is now easier than ever for financial institutions to track any default behaviour of loan applicants. Entrepreneurs looking for funding from banks must provide banks with information relating to their general credentials, financial situation and guarantees or collaterals that can be offered.

### General Credentials

This is where you, as an entrepreneur, provide the bank with background information on yourself. Such information includes:

- **Letter(s) of Introduction:** This letter should be written by a respected business person who knows you well enough to introduce you. The aim of this letter is set across your achievements and vouch for your character and integrity.

- **Your Profile:** This is basically your resume. You need to give the bank a good idea of your educational achievements, professional training, qualifications, employment record and achievements.
- **Business Brochure:** A business brochure typically provides information on company products, clients, how long the business has been running for etc.
- **Bank and Other References:** If you have an account with another bank, providing those bank references is a good idea.
- **Proof of Company Ownership or Registration:** In some cases, you may need to provide the bank with proof of company ownership and registration. A list of assets and liabilities may also be required.

### Financial Situation

Banks will expect current financial information on your enterprise. The standard financial reports you should be prepared with are:

- Balance Sheet
- Profit-and-Loss Account
- Cash-Flow Statement
- Projected Sales and Revenues
- Business Plan
- Feasibility Study

### Guarantees or Collaterals

Usually banks will refuse to grant you a loan without security. You can offer assets which the bank can seize and sell off if you do not repay the loan. Fixed assets like machinery, equipment, vehicles etc. are also considered to be security for loans.

## Say

- Tell the participants about the landing criteria of banks.

## Elaborate

Tell them – Your request for funding will have a higher chance of success if you can satisfy the following lending criteria:

- Good cash flow
- Adequate shareholders' funds
- Adequate security
- Experience in business
- Good reputation

### The Procedure

To apply for funding the following procedure will need to be followed.

- Submit your application form and all other required documents to the bank.
- The bank will carefully assess your credit worthiness and assign ratings by analyzing your business information with respect to parameters like management, financial, operational and industry information as well as past loan performance.
- The bank will make a decision as to whether or not you should be given funding.

### Say

- Tell the participants about the Enterprise Management. To manage your enterprise effectively you need to look at many different aspects, right from managing the day-to-day activities to figuring out how to handle a large scale event.

### Elaborate

Tell them – Let's take a look at some simple steps to manage your company effectively.

**Step 1:** Use your leadership skills and ask for advice when required.

**Step 2:** Divide your work amongst others – realize that you cannot handle everything yourself.

**Step 3:** Hire the right people for the job.

**Step 4:** Motivate your employees and train them well.

**Step 5:** Train your people to handle your customers well.

**Step 6:** Market your enterprise effectively.

**Trainer's Note:** These are supporting content to the Participant Manual, please adhere to the Participant Manual, Page No. 377 and explain trainees' the concept.

### Say

- Tell the participants about Considering Entrepreneurship.

### Elaborate

- Tell them – Questions to Ask Yourself before Considering Entrepreneurship:
- Why am I starting a business?
- What problem am I solving?

- Have others attempted to solve this problem before? Did they succeed or fail?
- Do I have a mentor<sup>1</sup> or industry expert that I can call on?
- Who is my ideal customer<sup>2</sup>?
- Who are my competitors<sup>3</sup>?
- What makes my business idea different from other business ideas?
- What are the key features of my product or service?
- Have I done a SWOT<sup>4</sup> analysis?
- What is the size of the market that will buy my product or service?
- What would it take to build a minimum viable product<sup>5</sup> to test the market?
- How much money do I need to get started?
- Will I need to get a loan?
- How soon will my products or services be available?
- When will I break even<sup>6</sup> or make a profit?
- How will those who invest in my idea make a profit?
- How should I set up the legal structure<sup>7</sup> of my business?
- What taxes<sup>8</sup> will I need to pay?
- What kind of insurance<sup>9</sup> will I need?
- Have I reached out to potential customers for feedback

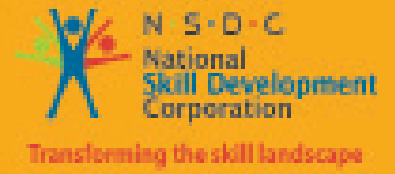
## Notes for Facilitation

- Summarise the main points of the unit.
- Ask participants if they have any doubts. Encourage them to ask questions.
- Answer their queries satisfactorily.
- Ask them to answer the questions at the end of unit given in the participant's manual.
- Ensure that every participant answer all questions.





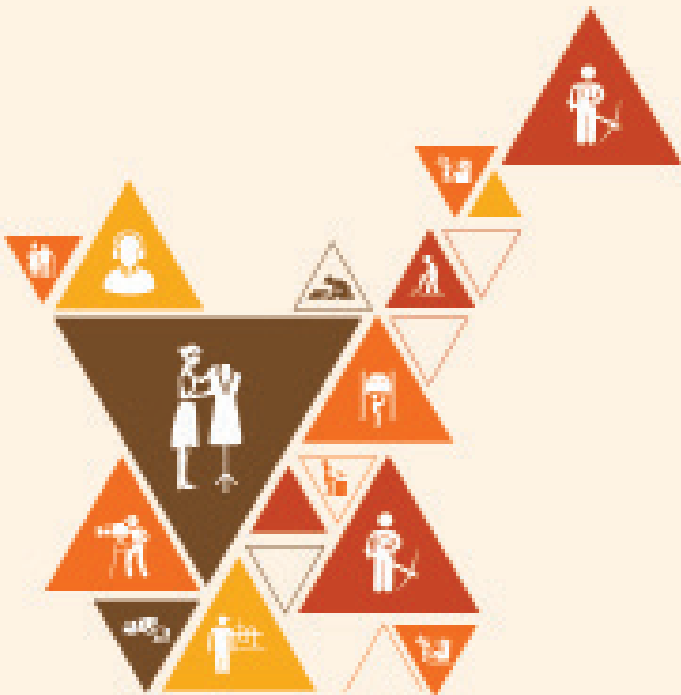
**Skill India**  
कौशल भारत - कुशल भारत



## 10. Annexures

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria



## Annexure I

## Training Delivery Plan

Training Delivery Plan			
<b>Program Name:</b>	Junior Rubber Technician		
<b>Qualification Pack Name &amp; Ref. ID</b>	RSC/Q0831		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	As per QP
<b>Pre-requisites to Training</b>	Training on operation of machinery		
<b>Training Outcomes</b>	By the end of this program, the participants will be able to: <ol style="list-style-type: none"> <li>1. Assisting the operator in material handling in weigh</li> <li>2. Assisting the operator in production process and equipment handling</li> <li>3. Assisting the operator in post-production process</li> </ol>		

Sl. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
1.	Global and National Status of Rubber Industry	Global and National Status of Rubber Industry	<b>Theory:</b> 1. Learn about current state of Rubber Industry in India 2. Recognize types of Rubber used in Industry 3. Familiarise with the process the Rubber Manufacturing	Bridge Module	<ul style="list-style-type: none"> <li>Facilitator-led – Discussion</li> <li>Demonstration</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
2.	Machines used in Rubber Product Manufacturing	Introduction to rubber processing machinery	<b>Theory:</b> 1. Recognize different machineries used in rubber processing. 2. Identify various machines used in rubber processing.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	1:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge of Tools and Equipment.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	2:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge of Mixing Equipment.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	2:00 hrs.
		Mixing Mills	<b>Theory:</b> 1. Paraphrase mixing mills in rubber processing.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<b>Theory:</b> 1. Operating mixing mills.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge of Mixing Mills</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	6:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge to operate mixing mill</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
		Internal Mixers	<b>Theory:</b> 1. Learn about development of Internal Mixers.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	6:00 hrs.
			<b>Theory:</b> 1. Learn about Mixing Mechanisms in Internal Mixers. 2. Learn about Mixing Methods in Internal Mixing. 3. Variable Parameters in Internal Mixing.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<b>Theory:</b> 1. Learn about discharge criteria in Internal Mixing. 2. Multistage Mixing in Internal Mixing. 3. Learn about Internal Mixer-Pre and Post Mixer Arrangements.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<b>Theory:</b> 1. Learn about Tandem Mixing-A New Ancillary Combination in Internal Mixing.		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	1:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge about development of internal mixers.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
			<b>Practical: Demonstrate</b> <ul style="list-style-type: none"> <li>Gain practical knowledge of the internal mixer- functional parts.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.

		Extruders	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Learn about Extruders.</li> <li>2. Types of Extruders.</li> <li>3. Learn about Combination of Extruders.</li> <li>4. Learn about the major parts of an Extruder</li> <li>5. Learn about Ancillary Equipment.</li> <li>6. Learn about Extruder Operation.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	4:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge of extruders its types.</li> <li>• Gain practical knowledge about combination of extruders.</li> <li>• Gain practical knowledge about major parts of an extruder.</li> <li>• Gain practical knowledge about ancillary equipment.</li> <li>• Gain practical knowledge of extruder operation.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
		Calenders	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Recognize calendar machines and calendaring process.</li> <li>2. Classify calendar and major parts of calendar.</li> <li>3. Perform extruder operation.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	4:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge to recognize calendar machines and calendaring process.</li> <li>• Gain practical knowledge to classify calendar and major parts of calendar.</li> <li>• Gain practical knowledge to perform extruder operation.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Equipment used in latex based industry	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Learn about equipment used to prepare dispersions.</li> <li>2. Learn about equipment used to prepare Emulsions.</li> <li>3. Learn about Latex compounding mixer.</li> <li>4. Learn about Latex dipping tank.</li> <li>5. Learn about drying open</li> <li>6. Learn about leaching tank.</li> <li>7. Learn about dehydration unit.</li> <li>8. Learn about Vulcanising unit.</li> <li>9. Learn about equipment used in final finishing operation.</li> <li>10. Learn about latex thread making machine.</li> <li>11. Learn about other Miscellaneous equipment.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge of different equipment of latex based industry.</li> <li>• Gain practical of equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanising unit etc.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
3.	Maintenance and Upkeep of Machinery	Introduction to Maintenance	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Learn about maintenance aspects of machinery.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge of maintenance aspects of machinery.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.

		Objectives of Maintenance	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Familiarise with the objectives of machine/equipment maintenance.</li> <li>2. Explain why maintenance of machine and equipment is necessary.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about the objectives of machine/equipment maintenance.</li> <li>• Gain practical knowledge about</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	3:00 hrs.
		Types of Maintenance	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Identify various types of maintenance.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	4:00 hrs.
			<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Perform maintenance type like RTF, PM, CM etc.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	8:00 hrs.
		Types of Maintenance	<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge on various types of maintenance.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge on various types of maintenance.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
		Familiarisation of tools	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Familiarise with various tools used in rubber processing.</li> <li>2. Identify and understand equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanising unit etc.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	4:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about various tools used in rubber processing.</li> <li>• Gain practical knowledge of equipment like compounding mixer, drying oven, leaching tank, dipping tank, dehydration unit, vulcanising unit etc.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Hazards and Risks in Maintenance Activity	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Identify various hazards and risks involved in maintenance activity.</li> <li>2. Act on preventive measure to avoid hazards and risks.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	6:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about various hazards and risks involved</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about various hazards and risks involved .</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
4.	Assisting the Operation in Material Handling in Weing	Introduction to Material Handling Equipments	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Identify various material handling equipment used in rubber processing.</li> <li>2. Categorise the material handling equipment.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.

			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge of various material handling equipment used in rubber processing.</li> <li>Gain practical knowledge to categorise the material handling equipment.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Transport Equipment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Identify various transport equipment used in rubber processing.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	6:00 hrs.
			<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Use equipment like cranes, conveyors, industrial trucks etc.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	6:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about various transport equipment used in rubber processing.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge to use equipment like cranes, conveyors, industrial trucks etc.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	6:00 hrs.
		Positioning equipment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Identify various positioning equipment used in rubber processing.</li> <li>Use equipment like lift, turn table, dock leveller, ball transfer table, manipulators.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about various positioning equipment used in rubber processing.</li> <li>Use equipment like lift, turn table, dock leveller, ball transfer table, manipulators.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	6:00 hrs.
		Unit Load Formation Equipment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Identify various load equipment used in rubber processing.</li> <li>Use equipment like pallets, skids, tote pans, cartons, shrink wrap etc.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	7:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about various load equipment used in rubber processing.</li> <li>Use equipment like pallets, skids, tote pans, cartons, shrink wrap etc.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
		Storage Equipment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Identify various storage equipment used in rubber processing.</li> <li>Use equipment like pallet rack, drive through rack etc.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about various storage equipment used in rubber processing.</li> <li>Use equipment like pallet rack, drive through rack etc.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
		Principles of designing and selecting	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Paraphrase the principles of designing and selecting material handling system.</li> </ol>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	1:00 hrs.

			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about the principles of designing and selecting material handling system.</li> </ul>	RSC/N3101 PC1 – PC10 KA1 – KA21 KB1 – KB4	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	3:00 hrs.
5.	Assisting the Operator in Production Process and Equipment Handling	Standard Operating Procedures	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Explain the standard operating procedures (SOPs) and their types.</li> <li>Prepare SOPs.</li> <li>Paraphrase the product life cycle.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about SOPs.</li> <li>Gain practical knowledge to prepare SOP.</li> <li>Gain practical knowledge about the product life cycle.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Weighing of ingredients	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Weigh the ingredients accurately.</li> <li>Understand the sequences of weighing.</li> <li>Store and identify the weighed materials.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Weigh the ingredients accurately.</li> <li>Gain practical knowledge of the sequences of weighing.</li> <li>Store and identify the weighed materials.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	3:00 hrs.
		Mastication, Master batching and final mixing	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Do the mastication, master batching and final mixing.</li> <li>Differentiate the methods of mastication.</li> <li>Ractify the advantages and disadvantages of final mixing.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Do the mastication, master batching and final mixing.</li> <li>Gain practical to differentiate the methods of mastication.</li> <li>Ractify the advantages and disadvantages of final mixing.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Note Pad, Pen, charts</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Extrusion and Calendaring	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Familiarise extrusion and calendaring.</li> <li>Understand various types of extrusions and calendaring.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge about extrusion and calendaring.</li> <li>Gain practical knowledge about various types of extrusions and calendaring.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
		Compression and Transfer Moulding	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Define the moulding.</li> <li>Classify the types of moulding.</li> <li>Familiarise with compression moulding.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	4:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge to classify the types of moulding.</li> <li>Gain practical knowledge of compression moulding.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
		Injection and Miscellaneous Moulding Techniques and Moulding Equipment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Familiarize with injection moulding and miscellaneous moulding.</li> <li>Use moulding press and mould design.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.

			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Gain practical knowledge of injection moulding and miscellaneous moulding.</li> <li>Gain practical knowledge to use moulding press and mould design</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	7:00 hrs.
		Post-moulding operations and Defects in Moulded Goods	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Familiarise with post moulding operations.</li> <li>Identify defects in moulded products.</li> <li>Use moulding press and mould design.</li> </ol>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Gain practical knowledge about post moulding operations.</li> <li>Identify defects in moulded products.</li> <li>Use moulding press and mould design.</li> </ul>	RSC/N3102 PC1 – PC15 KA1 – KA19 KB1 – KB8	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	7:00 hrs.
6.	Testing of Rubber, Rubber Compounds & Products	Testing of Rubbers	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Perform testings of rubber and blend of rubbers.</li> <li>Familiarise with the test methods of ISNR as per the specifications (IS: 4588-1986)</li> <li>Identify the chemical tests for synthetic rubbers.</li> </ol>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led – discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	3:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Perform testings of rubber and blend of rubbers.</li> <li>Gain practical knowledge of the test methods of ISNR as per the specifications (IS: 4588-1986)</li> <li>Gain practical knowledge of the chemical tests for synthetic rubbers.</li> </ul>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Testing of Rubber compounds	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Prepare sample.</li> <li>Identify rubber compounds.</li> <li>Performs tests like specific gravity, viscosity.</li> </ol>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	5:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Prepare sample.</li> <li>Gain practical knowledge of rubber compounds.</li> </ul>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Performs tests like specific gravity, viscosity.</li> </ul>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	5:00 hrs.
		Testing of Rubber Products	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Perform physical testing of rubber products.</li> <li>Undertake rubber product tests like hardness test, tensile strain/stress test, tear test, abrasion test, flex cracking, heat build up test, rebound resilience test,</li> <li>Identify electric and temperature properties of rubber products.</li> </ol>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	8:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Perform physical testing of rubber products.</li> <li>Undertake rubber product tests like hardness test, tensile strain/stress test, tear test, abrasion test, flex cracking, heat build up test, rebound resilience test,</li> </ul>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.
			<ul style="list-style-type: none"> <li><b>Practical: Demonstrate</b> Identify electric and temperature properties of rubber products.</li> </ul>	RSC/N3103 PC1 – PC8 KA1 – KA24 KB1-KB6	<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	8:00 hrs.



7.	Standard and Safety	Standard and Specifications- Systems	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Paraphrase the quality control and its system.</li> <li>2. Familiarise with the concept and role of ISO- 9000 and ISO- 9001.</li> <li>3. Explain the product realization.</li> </ol>	RSC/N5002 PC1 – PC10 KA1 – KA14	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about the quality and its system.</li> <li>• Gain practical knowledge about product realization.</li> </ul>	RSC/N5002 PC1 – PC10 KA1 – KA14	<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Standards and Specifications- Products	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Classify various quality standards required to be fulfilled by a product.</li> <li>2. Identify BIS specifications for rubber products.</li> <li>3. Explain standards to conform for pharmaceutical usage of rubber.</li> <li>4. Identify other quality standards rubber products.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge about various quality standards required to be fulfilled by a product.</li> <li>• Identify BIS specifications for rubber products.</li> <li>• Explain standards to conform for pharmaceutical usage of rubber.</li> <li>• Identify other quality standards rubber products.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Safety Aspects Related to the Machine Operation	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Beware with health and safety parameters related to operations of machines.</li> <li>2. Take care of health and safety while mixing and finishing operations.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	1:00 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge health and safety parameters related to operations of machines.</li> <li>• Gain practical knowledge to take care of health and safety while mixing and finishing operations.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	2:00 hrs.
		Safety at Workplace	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Perform the safety and health at workplace.</li> <li>2. Recognize the different PPE's.</li> <li>3. Handle the material and control vehicle movement at work premise.</li> <li>4. Prevent yourself and your team from different types of physical hazards.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:0 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>• Gain practical knowledge to Perform the safety and health at workplace.</li> <li>• Gain practical knowledge to recognize the different PPE's.</li> <li>• Gain practical knowledge to handle the material and control vehicle movement at work premise.</li> <li>• Gain practical knowledge to prevent yourself and your team from different types of physical hazards.</li> </ul>		<ul style="list-style-type: none"> <li>• Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
		Good manufacturing practices-5S concept	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Do the good manufacturing practices.</li> <li>2. Familiarise with the '5S' technique.</li> </ol>		<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	1:00 hrs.

			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge to do the good manufacturing practices.</li> <li>Gain practical knowledge of the 5S technology.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	2:00 hrs.
		First Aid and CPR	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Apply first aid on an injured person.</li> <li>Perform CPR.</li> </ol>		<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	2:0 hrs.
			<p><b>Practical: Demonstrate</b></p> <ul style="list-style-type: none"> <li>Gain practical knowledge to apply first aid on an injured person.</li> <li>Gain practical knowledge to perform CPR.</li> </ul>		<ul style="list-style-type: none"> <li>Practical Lab</li> </ul>	Note Pad, Pen, charts	4:00 hrs.
8.	IT Skills	Introduction to Computer	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Define the computer.</li> <li>Recognise its various parts.</li> <li>Differentiate the advantages and disadvantages of computer.</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		Basic Computer Knowledge	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Use computer.</li> <li>Explain the web, email services.</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		Components of Computer	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Know the different parts and components of computer.</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		Concept of Operating System	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Familiarise with the concept of operating system.</li> <li>Work on Windows 8 and 8.1.</li> <li>Add or Remove desktop icons, make or delete a folder etc.</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		MS Word	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Learn the concept of and practice MS-Word.</li> <li>Format a document.</li> <li>Print a document etc.</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals n Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		MS Power Point	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Practice MS – Power point.</li> <li>Make a new presentation.</li> <li>Format a slide as well</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		MS Excel	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Work on MS-Excel</li> <li>Format cells and cell content</li> <li>Use formulas</li> <li>Make Charts and Pivot Table</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
		Internet Concepts	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>Understand internet concepts</li> <li>Recognise the different types of URLs</li> <li>Use MS-Outlook</li> </ol>	Digital Literacy	<ul style="list-style-type: none"> <li>Power-point presentation</li> <li>Facilitator- led - discussion</li> <li>Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	

9.	Employability and Entrepreneurship skills	Personal Strengths & Value Systems	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Explain the meaning of health</li> <li>2. List common health issues</li> <li>3. Discuss tips to prevent common health issues</li> <li>4. Explain the meaning of hygiene</li> <li>5. Understand the purpose of Swacch Bharat Abhiyan</li> <li>6. Explain the meaning of habit</li> <li>7. Discuss ways to set up a safe work environment</li> <li>8. Discuss critical safety habits to be followed by employees</li> <li>9. Explain the importance of self-analysis</li> <li>10. Understand motivation with the help of Maslow's Hierarchy of Needs</li> <li>11. Discuss the meaning of achievement motivation</li> <li>12. List the characteristics of entrepreneurs with achievement motivation</li> <li>13. List the different factors that motivate you</li> <li>14. Discuss how to maintain a positive attitude</li> <li>15. Discuss the role of attitude in self-analysis</li> <li>16. List your strengths and weaknesses</li> <li>17. Discuss the qualities of honest people</li> <li>18. Describe the importance of honesty in entrepreneurs</li> <li>19. Discuss the elements of a strong work ethic</li> <li>20. Discuss how to foster a good work ethic</li> <li>21. List the characteristics of highly creative people</li> <li>22. List the characteristics of highly innovative people</li> <li>23. Discuss the benefits of time management</li> <li>24. List the traits of effective time managers</li> <li>25. Describe effective time management technique</li> <li>26. Discuss the importance of anger management</li> <li>27. Describe anger management strategies</li> <li>28. Discuss tips for anger management</li> <li>29. Discuss the causes of stress</li> <li>30. Discuss the symptoms of stress</li> <li>31. Discuss tips for stress management</li> <li>32. Discuss tips for stress management</li> </ol>	Bridge Module	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
----	---	------------------------------------	--	---------------	--	--	--

	Digital Literacy: A Recap	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Identify the basic parts of a computer</li> <li>2. Identify the basic parts of a keyboard</li> <li>3. Recall basic computer terminology</li> <li>4. Recall basic computer terminology</li> <li>5. Recall the functions of basic computer keys</li> <li>6. Discuss the main applications of MS Office</li> <li>7. Discuss the benefits of Microsoft Outlook</li> <li>8. Discuss the different types of e-commerce</li> <li>9. List the benefits of e-commerce for retailers and customers</li> <li>10. Discuss how the Digital India campaign will help boost e-commerce in India</li> <li>11. Describe how you will sell a product or service on an e-commerce platform</li> </ol>	Bridge Module	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
	Money Matters	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the importance of saving money</li> <li>2. Discuss the benefits of saving money</li> <li>3. Discuss the main types of bank accounts</li> <li>4. Describe the process of opening a bank account</li> <li>5. Differentiate between fixed and variable costs</li> <li>6. Describe the main types of investment options</li> <li>7. Describe the different types of insurance products</li> <li>8. Describe the different types of taxes</li> <li>9. Discuss the uses of online banking</li> <li>10. Discuss the main types of electronic funds transfers</li> </ol>	Bridge Module	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
	Preparing for Employment and Self Employment	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the steps to prepare for an interview</li> <li>2. Discuss the steps to create an effective Resume</li> <li>3. Discuss the most frequently asked interview questions</li> <li>4. Discuss how to answer the most frequently asked interview questions</li> <li>5. Discuss basic workplace terminology</li> </ol>	Bridge Module	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	

	Understanding Entrepreneurship	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Discuss the concept of entrepreneurship</li> <li>2. Discuss the importance of entrepreneurship</li> <li>3. Describe the characteristics of an entrepreneur</li> <li>4. Describe the different types of enterprises</li> <li>5. List the qualities of an effective leader</li> <li>6. Discuss the benefits of effective leadership</li> <li>7. List the traits of an effective team</li> <li>8. Discuss the importance of listening effectively</li> <li>9. Discuss how to listen effectively</li> <li>10. Discuss the importance of speaking effectively</li> <li>11. Discuss how to speak effectively</li> <li>12. Discuss how to solve problems</li> <li>13. List important problem solving traits</li> <li>14. Discuss ways to assess problem solving skills</li> <li>15. Discuss the importance of negotiation</li> <li>16. Discuss how to negotiate</li> <li>17. Discuss how to identify new business opportunities</li> <li>18. Discuss how to identify business opportunities within your business</li> <li>19. Understand the meaning of entrepreneur</li> <li>20. Describe the different types of entrepreneurs</li> <li>21. List the characteristics of entrepreneurs</li> <li>22. Recall entrepreneur success stories</li> <li>23. Discuss the entrepreneurial process</li> <li>24. Describe the entrepreneurship ecosystem</li> <li>25. Discuss the government's role in the entrepreneurship ecosystem</li> <li>26. Discuss the current entrepreneurship ecosystem in India</li> <li>27. Understand the purpose of the Make in India campaign</li> <li>28. Discuss the relationship between entrepreneurship and risk appetite</li> <li>29. Discuss the relationship between entrepreneurship and resilience</li> <li>30. Describe the characteristics of a resilient entrepreneur</li> <li>31. Discuss how to deal with failure</li> </ol>	Bridge Module	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals</li> <li>• Images</li> </ul>	Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.	
--	--------------------------------	--	---------------	---	--	--

		<p>Preparing to be an Entrepreneur</p>	<p><b>Theory:</b></p> <ol style="list-style-type: none"> <li>1. Discuss how market research is carried out</li> <li>2. Describe the 4 Ps of marketing</li> <li>3. Discuss the importance of idea generation</li> <li>4. Recall basic business terminology</li> <li>5. Discuss the need for CRM</li> <li>6. Discuss the benefits of CRM</li> <li>7. Discuss the need for networking</li> <li>8. Discuss the benefits of networking</li> <li>9. Understand the importance of setting goals</li> <li>10. Differentiate between short-term, medium-term and long-term goals</li> <li>11. Discuss how to write a business plan</li> <li>12. Explain the financial planning process</li> <li>13. Discuss ways to manage your risk</li> <li>14. Describe the procedure and formalities for applying for bank finance</li> <li>15. Discuss how to manage your own enterprise</li> <li>16. List important questions that every entrepreneur should ask before starting an enterprise</li> </ol>	<p>Bridge Module</p>	<ul style="list-style-type: none"> <li>• Power-point presentation</li> <li>• Facilitator- led - discussion</li> <li>• Audio- visuals</li> <li>• Images</li> </ul>	<p>Available Objects such as a book, pen, duster, white board, marker, Computer, Projector etc.</p>	
--	--	--	--	----------------------	---	---	--

## Annexure II

### Assessment Criteria

#### CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for Hand Embroiderer	
Job Role	Junior Rubber Technician /Technical Assistant
Qualification Pack	RSC/ Q 0831
Sector Skill Council	Rubber Skill Development Council
Sr. No.	Guidelines for Assessment
1	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 70% in every NOS
6	In case of successfully passing only certain number of NOS's, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack

NOS	Elements	Performance Criteria	Total	Theory	Practical
1. RSC / N 3101 Assisting the operator in material handling in weing	Material Handling	PC1. Assist raw material handling Operators to identify various raw materials used in the rubber industry (polymer, filler, processing aids, curatives, special additives etc.)	7	5	2
		PC2. Assist raw material handling operators in the raw material storage area with respect identification, traceability including housekeeping & safety as per SOP.	7	5	2
		PC3. Assist Lab Technician for sampling of raw material from the storage area as per SOP.	8	5	3
		PC4. Assist raw material weighing operators for preparation of mix as per SOP.	8	5	3
		PC5. Assist Mixing Operators for mixing of compounds – master batch, final as per SOP	10	5	5
		PC6. Assist Lab Technician for collection of compounds with proper identification as per SOP.	10	5	5
		PC7. Assist mixing operators for identifying different compounds in the mixing area	10	5	5
		PC8. Assist Material Handling Operators for storage of compounds with proper identification in the storage	10	5	5

		area as per SOP.			
		PC9. Assist Mixing Operator for maintaining records for traceability.	10	5	5
	Health and Safety	Awareness on different safety devices (safety bar, safety guard etc) attached with different Rubber Processing Machineries.	10	5	5
	Material disposal	Awareness on Material Safety Data Sheet (MSDS) PC10. Assist to carry out disposal of waste and left over tested material safely as per SOP	10	5	5
			100	55	45
2. RSC / N 3102 Assisting the operator in Production process and equipment handling	Equipment and machinery handling	PC1. Assist in identifying different material/compound and component required for different rubber processing (mixing, dipping, extrusion, calendaring, component preparation, building, moulding/curing).	5	5	0
		PC2. Assist in raw material handling operators in the raw material storage area with respect to identification, traceability including housekeeping & safety as SOP.	5	5	0
		PC3. Assist Lab Technician for sampling of raw material from the storage area, collection of compounds and components as per SOP.	5	5	0
		PC4. Assist raw material weighing operators for preparation of mix as per SOP.	5	5	0
		PC5. Assist Mixing Operators for mixing of compounds – master batch, final as per SOP.	10	5	5
		PC6. Assist extrusion operator for extrusion process (pre, during and post)	10	5	5
		PC7. Assist fabric dipping operation	5	5	0
		PC8. Assist calendaring operation	5	5	0
		PC9. Assist component preparation	5	5	0
		PC10. Asst. Building operation	10	5	5
		PC11. Assist Curing/moulding operation	10	5	5
		PC12. Assist Finishing operation	5	5	0
		PC13. Assist Material Handling Operators for storage of compounds with proper identification in the storage area as per SOP.	5	5	0



		10			
	Health and Safety	Awareness on different safety devices (safety bar, safety guard etc) attached with different Rubber Processing Machineries.	5	5	0
	Material disposal	PC15. Carry out disposal of waste and left over tested material safely as per SOP	5	5	0
			100	80	20
3. RSC/N 3103 Assisting the operator in post production process	Testing & Quality check	PC1. Collection of components and check for building	10	5	5
		PC2. Prepare the machineries	0	5	5
		PC3. Building the products,	0	5	5
		PC4. Green Product inspection	0	5	5
		PC5. Curing/Moulding	0	5	10
		PC6. Finishing & finished product inspection.	0	5	5
		PC7. Sampling and Testing	0	5	10
	Health and Safety	Awareness on different safety devices (safety bar, safety guard etc) attached with different Rubber Processing Machineries.	10	5	5
Material disposal	PC8. Carry out disposal of waste and left over tested material safely as per SOP	0	5	5	
			100	45	55

### Do

- Explain each Guideline for Assessment in detail
- Explain the score that each trainee needs to obtain
- Recapitulate each NOS one-by-one and take participants through the allocation of marks for Theory and Skills Practical.
- Explain the Allocation of Marks. Explain that they will be assessed on Theory and Skills Practical.



**Skill India**  
विद्यया ऽमृतमश्नुते - अज्ञानं मृतं



**Rubber Skill Development Council**

Address: PHD House (4th Floor), Opp. Asian Games Village, Siri Fort Institutional Area,  
New Delhi - 110016

Tele:+91 11 41009347, 41009348 | E-mail: [info@rsdcindia.in](mailto:info@rsdcindia.in)

Price: ₹