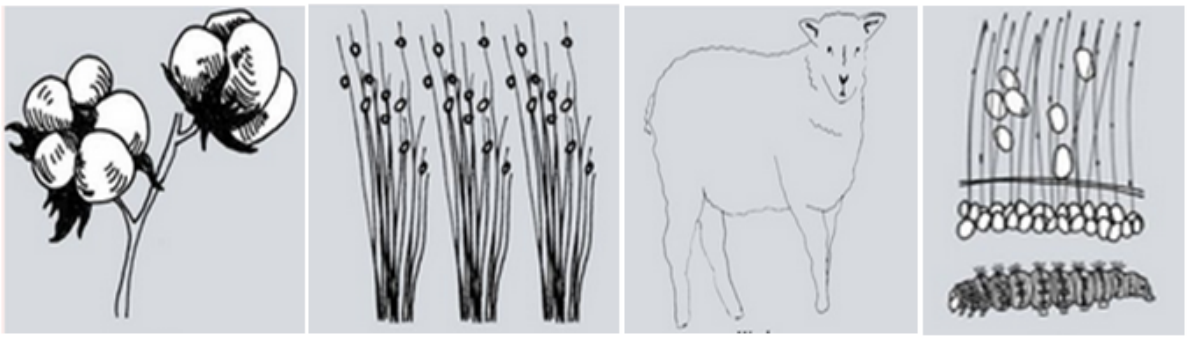
TEXTILE PROCESSING TECHNOLOGY

Level-I

Based on February, 2022, Curriculum Version 1



Module Title: - Identifying Inputs for Textile Processing

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Nominal duration: 60 Hours

Prepared by: Ministry of Labor and Skill

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Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the responsible representatives of TVET instructors in Textile Technology experts who donated their precious time devotedly and expertise for the successful development of this Teaching, Training and Learning Materials (TTLM).

Acronym

SOP – Standard Operating Procedure

OG - Operational Guidance

WHS - Work health and safety

PPE - Personal Protective Equipment

PPI – Picks Per Inch

ASTM – American Standard Test Method

Introduction to the Module

In the field of Textile Processing Technology; understanding the concept inputs for textile processing helps to understand in fibers, yarns, fabrics and textile chemicals and how they are used in textile processing production. This module is designed to meet the industry requirement under the Textile Processing Technology Occupational standard, particularly for the unit of competency: **Identify Inputs for textile processing.**

This Module Covers the Units:

→ Job requirements

→ Types and characteristics of textile materials

→ Textile processing methods

→ Handle and store materials

Learning Objective of the Module

→ Determine job requirements

→ Identify types and characteristics of textile materials

→ Identify textile processing methods

→ Handle and store materials

Module Instruction

For using the modules effectively, trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Read the identified reference book for Examples and exercise

Unit One: Job requirements

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Standard operating procedures (SOPs)
- → Work health and safety (WHS)
- → Personal protective equipment (PPE)
- → Job requirements

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Recognize the standard operating procedures of a job requirement
- ☺ Undertaking work healthy and safety
- ☺ Applying personal protective equipments appropriately
- ☺ Interpreting the requirements for a job

1.1. Standard operating procedures (SOPs)

1.1.1. Definition of Standard Operating Procedure

An SOP is a procedure specific to your operation that describes the activities necessary to complete tasks in accordance with industry regulations, provincial laws or even just your own standards for running your business. Any document that is a "how to" falls into the category of procedures. In a manufacturing environment, the most obvious example of an SOP is the step by step production line procedures used to make products as well train staff.

1.1.2. Essential considerations of SOPs for productions/operations

A. Production line steps

A production line is a factory configuration that features a series of manufacturing steps. Items flow from step-to-step moving closer to becoming a finished product, part or component with each step. Production lines are used both in *batch production* and *mass production*.

Batch production involves moving a set of items through each step together as a batch. For example, Batch production is a method whereby a group of identical products are produced simultaneously (rather than one at a time).

Mass production is the manufacturing of large quantities of standardized products, often using assembly lines or automation technology. Mass production facilitates the efficient production of a large number of similar products.

B. Equipment maintenance

What is equipment maintenance?

Equipment maintenance is any process used to keep a business's equipment in reliable working order. It may include routine upkeep as well as corrective repair work. Equipment may include mechanical assets, tools, heavy off-road vehicles, and computer systems.

Types of equipment maintenance workers

Equipment maintenance workers may include technicians, supervisors, and managers.

→ **Maintenance technicians**

Equipment maintenance technicians handle general upkeep and repair work on a business's equipment. They may also be involved in diagnostic testing and routine inspections as directed by their supervisors.

→ **Maintenance supervisors**

Equipment maintenance supervisors oversee technicians and plan maintenance tasks for each day. They make sure all health and safety requirements are met, manage workloads, and handle preventive maintenance planning.

→ **Maintenance managers**

An equipment maintenance manager handles high level planning and oversees maintenance supervisors. Their planning is centered on meeting the department's long-term goals rather than day-to-day requirements, though their tasks may overlap somewhat with those of supervisors.

1.1.3. Sector or subdivisions of textile industries that use equipment maintenance

In a textile factory/industry list of processes and operations which uses any kind required equipment for the uses of equipment maintenance are:

- Pretreatment processing
- Coloration processing
- Final finishing processing

Here are five points about the procedures of an inspection

a) Select appropriate duty holders for inspection – should be aligned with divisional work plans

b) Gather relevant information - should given in consideration with records of previous interventions, incidents, concerns, enforcement & ratings.

c) Identify the objectives of the inspection - inspection objectives should align with divisional work plans and take into account relevant Operational Guidance (OGs) and sector plans.

d) Select an appropriate inspection method - How to meet the inspection objectives in the most effective and efficient way

e) Make preparations for the inspection - Suitable arrangements should be made by Planning to address the significant risks and underlying management systems Deciding what resources, including any particular knowledge, skills or specialist input are required for the inspection.

1.1.4. Establish Your Process for Training New Employees

If you don't already have a new hire training program in place, you need to start by figuring out what every employee needs to know.

a) Identify Tasks or Procedures Employees Need to Know

Talk to managers in each department to find out what type of information would be beneficial for which roles. This is also a great way to identify what different roles can learn about other departments to increase inter-departmentalism.

Product and service training is beneficial for not only the sales team but all members of your organization**.**

b) Identify Who Should Conduct the Training

It's unlikely that one person will train every employee in every skill. Chose the best person for the job, whether that's a specific training professional, a manager, or a peer.

c) Allocate Resources and Supplies

Training new hires is essential. Provide tools and time to learn new procedures and practices. You can't expect new employees to be productive right away without the means to accomplish their tasks.

d) Train

This one word could encompass a range of activities, such as online training, classroom training, and hands-on practice.

e) Check-in for Understanding

Check employee understanding after training by giving assignments about the training they received. Using a learning reinforcement boosts learning retention and helps to know if employees feel comfortable with what they learned or if they need more training.

1.2. Work health and safety (WHS)

Work health and safety (WHS) – sometimes called occupational health and safety (OH&S) – involves the management of risks to the health and safety of everyone in your workplace.

1.2.1. Benefits of WHS in your business

Creating a safe work environment is a legal requirement. It's also critical to the long term success of your business and can:

- ✓ help you keep your staff
- ✓ improve staff productivity
- ✓ reduce injury and illness in the workplace
- ✓ reduce the costs of injury and workers' compensation.

1.2.2. WHS requirements in your state or territory

Each state has its own WHS laws and a regulator to enforce them. The WHS framework for each state includes the:

- ✓ **Act** – outlines your broad responsibilities.
- ✓ **Regulations** – set out specific requirements for particular hazards and risks, such as noise, machinery, and manual handling.

- ✓ **Codes of practice** – provide practical information on how you can meet the requirements in the Act and Regulations.
- ✓ **Regulating agency (regulator)** – administers WHS laws, inspects workplaces, provides advice and enforces the laws. Check their website for WHS information and resources.

1.3. Personal protective equipment (PPE)

1.3.1. What is Hazard

A **hazard** is any source of potential damage, harm or adverse health effects on something or someone. Basically, a hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment).

1.3.2. The Requirement for PPE

To ensure the greatest possible protection for employees in the workplace, the cooperative efforts of both employers and employees will help in establishing and maintaining a safe and healthful work environment.

In general, employers are responsible for:

- ✓ Performing a "hazard assessment" of the workplace to identify and control physical and health hazards.
- ✓ Training employees in the use and care of the PPE and periodically reviewing the effectiveness of the PPE.

And employees should:

- ✓ Properly wear PPE,
- ✓ Attend training sessions on PPE,

1.3.3. The Hazard Assessment

A first critical step in developing a comprehensive safety and health program is to identify physical and health hazards in the workplace. This process is known as a "hazard assessment."

Examples of health hazards include overexposure to harmful dusts, chemicals or radiation.

The hazard assessment should begin with a walkthrough survey of the facility to develop a list of potential hazards in the following basic hazard categories like Impact, Penetration, Compression (roll-over), Chemical, Heat/cold, Harmful dust, Light (optical) radiation, and Biologic.

1.3.4. Selecting PPE

All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion. Employers should take the fit and comfort of PPE into consideration when selecting appropriate items for their workplace.

1.3.5. Training Employees in the Proper Use of PPE

Employers are required to train each employee who must use PPE. The different types of PPE are eye and face protection, head protection, foot and leg protection & hand and arm protection.

1.3.6. Eye and Face Protection

Employees can be exposed to a large number of hazards that pose danger to their eyes and face. It is required from employers to ensure that employees have appropriate eye or face protection if they are exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, potentially infected material or potentially harmful light radiation.

Prescription Lenses

Everyday use of prescription corrective lenses will not provide adequate protection against most occupational eye and face hazards, so employers must make sure that employees with corrective lenses either wear eye protection that incorporates the prescription into the design or wear additional eye protection over their prescription lenses.

Eye Protection for Exposed Employees

It is suggested that eye protection be routinely considered for use by employee who are engaged to work in the manufacturing sectors and employers of employees in any job categories should decide whether there is a need for eye and face PPE through a hazard assessment.

Types of Eye Protection

Selecting the most suitable eye and face protection for employees should take into consideration the following elements. Some of the most common types of eye and face protection include the following:

→ **Safety spectacles** - These protective eyeglasses have safety frames constructed of metal or plastic and impact-resistant lenses. Side shields are available on some models.

→ **Goggles** - These are tight-fitting eye protection that completely cover the eyes, eye sockets and the facial area immediately surrounding the eyes and provide protection from impact, dust and splashes. Some goggles will fit over corrective lenses.

→ **Welding Shields** - Constructed of vulcanized fiber or fiberglass and fitted with a filtered lens, welding shields protect eyes from burns caused by infrared or intense radiant light.

→ **Laser safety goggles** - These specialty goggles protect against intense concentrations of light produced by lasers.

→ **Face shields** - These transparent sheets of plastic extend from the eyebrows to below the chin and across the entire width of the employee's head.

1.3.7. Head Protection

Protecting employees from potential head injuries is a key element of any safety program. Employers must ensure that their employees wear head protection if any of the following apply:

- ✓ Objects might fall from above and strike them on the head;
- ✓ They might bump their heads against fixed objects, such as exposed pipes or beams; or
- ✓ There is a possibility of accidental head contact with electrical hazards.

Types of Hard Hats

There are many types of hard hats available in the marketplace today which are important for employers to understand. This can be done through a comprehensive hazard analysis and an awareness of the different types of protective headgear available. Hard hats are divided into three industrial classes:

→ **Class A hard hats** provide impact and penetration resistance along with limited voltage protection (up to 2,200 volts).

→ **Class B hard hats** provide the highest level of protection against electrical hazards, with high-voltage shock and burn protection (up to 20,000 volts).

→ **Class C hard hats** provide lightweight comfort and impact protection but offer no protection from electrical hazards.

1.3.8. Foot and Leg Protection

Employees who face possible foot or leg injuries from falling or rolling objects or from crushing or penetrating materials should wear protective footwear. Examples of situations in which an employee should wear foot and/or leg protection include:

- ✓ When heavy objects such as barrels or tools might roll onto or fall on the employee's feet;
- ✓ Working with sharp objects such as nails or spikes that could pierce the soles or uppers of ordinary shoes;
- ✓ Exposure to molten metal that might splash on feet or legs;

1.3.9. Hand and Arm Protection

If a workplace hazard assessment reveals that employees face potential injury to hands and arms that cannot be eliminated through engineering and work practice controls, employers must ensure that employees wear appropriate protection.

1.3.10. Types of Protective Gloves

There are many types of gloves available today to protect against a wide variety of hazards. The nature of the hazard and the operation involved will affect the selection of gloves. Gloves made from a wide variety of materials are designed for many types of workplace hazards. In general, gloves fall into four groups:

- ✓ Gloves made of leather, canvas or metal mesh;
- ✓ Fabric and coated fabric gloves;
- ✓ Chemical- and liquid-resistant gloves;
- ✓ Insulating rubber gloves

1.4. Job requirements

1.4.1. What is Job requirement?

Job requirements are “must haves” that an employer is looking for in a candidate for a certain job position. Job requirements aren’t just a list of specific qualifications, education, knowledge and skills needed for a particular position.

These qualifications include: Work experience, Skills (soft skills and/or technical skills), Specific knowledge, Education level and type, Professional licenses, accreditations and certifications, Personal qualities and attributes, Languages, Physical abilities

1.4.2. Importance of Job requirements

Job requirements are a crucial part of both job descriptions and job postings. They are equally important for both employers and job seekers.

a) For Employers

✓ Employer use job requirements as a way of preselecting potential candidates.

✓ Job requirements are used to communicate employer’s expectations from job seekers.

b) For Job seekers

✓ For job seekers, job requirements are the crucial part of job postings (job ads).

✓ If they match all the job requirements criteria, it means they are a good fit for a job.

Self-Check 1	True/False, Multiple Choice & Blank Test

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False questions

1. An SOP is a procedure specific to your operation that describes the activities necessary to complete tasks in accordance with industry regulations, provincial laws or even just your own standards for running your business.
2. A production line is a factory configuration that features a series of manufacturing steps.
3. Check employee understanding after training by giving assignments about the training they received.
4. Creating a safe work environment is a legal requirement and helps a business to improve the productivity of a staff.
5. Potential hazards may be physical or health-related and a comprehensive hazard assessment should identify hazards in both categories.
6. Employers are not required to train each employee for using PPE in the work place effectively.
7. Job requirements are "must haves" that an employer is looking for in a candidate for a certain job position.

Test II: Multiple Choice Questions.

1. ---------- is any process used to keep a business's equipment in reliable working order.

a) Troubleshooting b) equipment maintenance c) material handling d) none

2. one of the list of processes and operations which is used for removal of the impure material from the textile materials in a textile factory/industry are: a)pretreatment processing b) coloration processing c) final finishing processing d) garment

3. A --------- is any source of potential damage, harm or adverse health effects on something or someone. a)hazard b) PPE c) danger d) instrument

4. A process which is a first critical step in developing a comprehensive safety and health program is to identify physical and health hazards in the workplace is known as ----------.

Physical damage b) PPE c) hazard assessment d) quality control

Test III: Short Answer Questions.

1. We can use production lines both in _____ and _____.
2. ---------- involves moving a set of items through each step together as a batch.
3. _____ is the manufacturing of large quantities of standardized products, often using assembly lines or automation technology.
4. List out the types of equipment maintenance

   _____
   _____
   _____

5. What are the five points about the procedures of an inspection.

   _____
   _____
   _____
   _____
   _____

6. The five tasks which are used for establishing your process for the training of new Employees are:

   _____
   _____
   _____
   _____
   _____

7. List out the types of Eye Protection which can be used as personal protective Equipment.

   _____
   _____
   _____
   _____
   _____

8. List out the three classes of hard hats head protection which can be used as personal protective Equipment.

   _____
   _____
   _____

Unit Two: Types and characteristics of Textile Materials

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Definition and types of fibers
- → Definition and types of yarns
- → Types of fabric
- → Types of textile chemicals
- → Quality parameters of textile materials (fibers, yarns and fabrics)
- → The requirements of a textile product

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Identifying fibers types
- ☺ Identifying yarns types
- ☺ Identifying fabric types
- ☺ Identifying textile chemicals types
- ☺ Identifying fibers, yarns, fabric or textile chemicals quality
- ☺ Identifying textile material quality measuring method
- ☺ Confirming and clarifying textile product requirements

2.1. Definition and types of fibers

2.1.1. Textile fibers and their characteristics

Textile fibers are natural or synthetic structures that can be spun into yarn and woven, knitted, or bonded into fabric. Because the inherent characteristics of fibers directly relate to the finished fabric's performance and the maintenance required, understanding fibers and yarns will in turn help you to understand how to incorporate fabrics into your interior scheme. Textile fibers are generally classified in to Natural fibers and man-made fibers.

i. Natural Fibers

Natural fibers are fibers which are occurring in nature; which are originated from of vegetable/plant, animal, and mineral origin.

→ An examples of plant origin is cotton, flax, jute

→ An examples of animal origin is wool, silk

→ An examples of mineral origin is asbestos

a) Plant Origin

Cotton

Plant origin; derived from the cellulose fibres surrounding the seeds of the cotton plant.

- Cotton has good natural durability even stronger when wet.
- Can be affected by mildew, however, a mildew resistant finish can be applied.
- Cotton may shrink with laundering but this can be reduced through a finishing process known as sanforizing.

Linen

Plant origin; derived from the cellulose fibres growing inside the stalks of the flax plant.

- Linen is regarded as a luxury fibre because of its luster and texture.
- As with cotton, linen is vulnerable to acidic pollution and can be affected by mildew, causing the fibre to deteriorate over time.
- Considered to be the strongest natural fibre, humidity absorbent when constructed for upholstery it is very durable, particularly when blended with up to 10% nylon.

b) Animal Origin

Wool

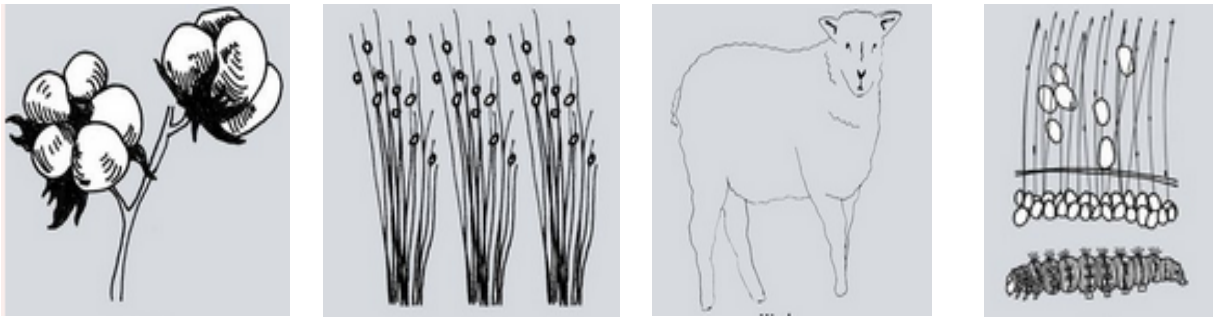
Animal origin; a natural animal fibre made from sheep fleece.

- ✓ Wool has regained popularity in interiors with growing demand for quality natural products.
- ✓ The crimp and fine molecular structure of this fibre ensures woolen textiles are elastic, allowing the yarn to stretch when pulled and helping it return to its original form.

Silk

Animal origin; the silkworm creates its cocoon from very long silk fibres which are harvested from mulberry trees.

Silk is naturally fine in texture, absorbent fiber and takes color beautifully. Unrivalled in splend our and smoothness, silk is regarded as the most exclusive of all natural fibres. Silk is a relatively strong fiber and can withstand a certain amount of abrasion, particularly when used in conjunction with a backing fabric.



Cotton fiber *Linen fiber* *Wool fiber* *Silk fiber*

Figure 2.1. Different types of natural fibers

Mineral Origin fibers

Mineral fibers are coming from the synthesis of molecules (glass fiber or glass wool produced from silica).

ii. Man-made fibers

Man-made fibres like plastics, man-made fibres are also made from polymers. Man-made fibres are not the same as natural fibres, such as silk, cotton and wool. There are two types of man-made fibres – *synthetic fibres and regenerated fibres*.

a) Regenerated Fibers

Definition: regenerated fibers are types of man-made fibers in which they are origins from natural cellulosic plants. Examples of regenerated fibers is viscose rayon.

Viscose/Rayon

Plant origin; Viscose/rayon is a transparent fibre made of processed cellulose. Cellulose fibres from wood or cotton are dissolved in alkali to make a solution called viscose, which is then extruded through a nozzle or spinneret into an acid bath to reconvert the viscose into cellulose. The term 'viscose' is widely used in Europe, whilst 'rayon' is American terminology.

- ✓ The soft handle, very absorbent fibre and beautiful luster provides a luxury finish, and viscose can be adapted from fine to heavy fibres to meet requirements.
- ✓ Can be affected by mildew.

Figure 2.2. Viscose Rayon fiber

b) Synthetic Fibres

Synthetic fibers are fibers which are man-made origin, and not occurring naturally. They are manufactured from different raw materials. Examples of synthetic fibers are polyester, nylon, and acrylic, Polypropylene / Olefin / Polyolefin.

Polyester

- ✓ Polyester fibres can be manufactured and woven/knitted for a specific use, from fine sheers to heavy upholsteries, with a very good drape and handle.
- ✓ Durability, strong and stable, abrasion resistance, and UV light resistance is generally very good.
- ✓ A non-absorbent fibre, it will move very little in humid conditions.
- ✓ Not affected by acidic pollution or mildew.

Nylon

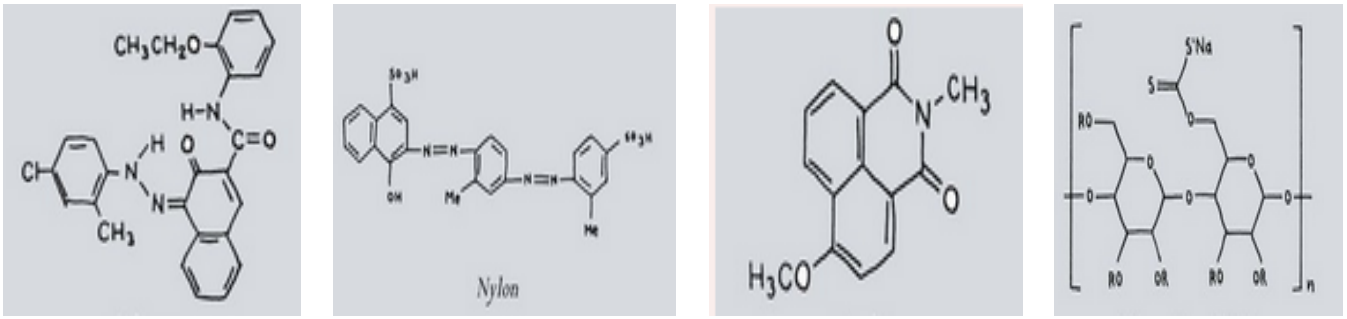
- ✓ Nylon can be manufactured and woven for specific use, from fine sheers to heavy upholsteries.
- ✓ The fibre is generally not affected by mildew and it is very strong and stable fibre.

Acrylic

- ✓ Acrylic fibres can be manufactured and woven for a specific use, from fine sheers to heavy upholsteries, with a very good drape and handle.
- ✓ Durability, strong and stable, excellent UV resistance and abrasion resistance is good when produced for upholstery application, but it can be susceptible to pilling.

Polypropylene / Olefin / Polyolefin

- ✓ A synthetic yarn from the polyolefin family which is a by-product of the petrochemical industry. Olefin, polyolefin and polypropylene share the same performance characteristics and are generally used to manufacture outdoor textiles.
- ✓ Excellent color fastness and resistance to fading and are mostly suitable for outdoor application when the fabric has been solution dyed.



Polyester fiber *Nylon* *Acrylic fiber* *PP/Olefin/Poly Olefin fiber*

Figure 2.3. Synthetic fibers

2.2. Definition and types of yarns

Yarn is a long continuous length of interlocked (twisted) fibers, suitable and used as an input material for use in the production of textiles like weaving, knitting, embroidery, sewing thread and crocheting.

Yarns can be made either from spun fibers or filament fibers. Yarns which are manufactured from spun fibers are called spun yarns. It is made by twisting staple fibers together to make a cohesive thread, or single yarn.

Yarn is composed of twisting strands of fiber, which are known as plies when grouped together. These strands of yarn are twisted together (plied) in the opposite direction to make a thicker yarn. Depending on the direction of this final twist, the yarn will have either S-twist (counter clock wise direction) or Z-twist (clock wise direction).

S twisted yarn *Z twisted yarn*

Figure 2.4. yarn directions

2.2.1. Types of yarns

Carded and combed yarn – combed yarns are produced by adding another step of yarn spinning, namely combing, which aligns the fibers and removes the short fibers carried over from the previous step of carding. Carded yarns are slightly more expensive, because the weaving is a long, consuming process.

Hosiery yarn – hosiery yarns are used in the manufacturing of knitted fabrics. Since the knitted materials are more delicate than woven materials, hence hosiery yarns are made 'softer' with few twists per inch than their woven counterparts.

Open-end yarn – open-end yarn is produced by open-end spinning without a spindle. The method of spinning is different from ring spinning. In open-end yarn, there is no roving frame stage. Sliver from the card goes into the rotor, is spun in to yarn directly.

Filament yarn – filament yarn consists of filament fibers (very long continuous fibers) either twisted together or only grouped together.

Texturized yarn – texturized yarns are made by a process of air texturizing filament yarns (sometimes referred to as taslanizing, which combines multiple filament yarns into a yarn with some of the characteristics of spun yarns. They are synthetic continuous filaments that are modified to impart special texture and appearance.

2.3. Types of fabric

Textile fabric is defined as two dimensional plane-like structure made of textile materials, having reasonable strength, elongation, flexibility, etc., used for different applications, particularly for apparels.

2.3.1. The Different Types of Fabric

First, "fabric" is a material made by entwining fibers together. Generally, a fabric is named after the fiber user to manufacture it; some fabrics will even use a blend of different fibers.

a) Natural vs. Synthetic

Natural fibers are obtained from plants and animals. For example, cotton comes from plants while silk comes from silkworms.

Synthetic fibers, on the other hand, are made entirely synthetic matter created by man.

b) Woven vs. Knitted

Woven fabrics are made up of two pieces of yarn that interweave horizontally and vertically on a loom. The fabric consists of a weft (when the yarn goes across the width of the fabric) and a warp (when the yarn goes down the length of the loom). There are three types of woven fabric: plain weave, satin weave and twill weave. Examples of popular woven fabrics are chiffon, crepe, denim, linen, satin and silk.

For knit fabric, think of a hand-knit scar; the yarn is formed into an interconnecting loop design, which allows it to stretch significantly. There are two types of knit fabric: warp-knitted and weft-knitted. Examples of popular knit fabrics are lace, lycra and mesh.

The different types of fabrics which are manufactured by textile processing operations and available in the market are as follows:

- **Chifon**

Chiffon is a sheer, lightweight, plain-woven fabric made from twisted yarn that gives it a slightly rough feel. The yarn is usually made of silk, nylon, polyester or rayon.

- **Cotton**

Cotton is known as the most popular material in the world, cotton is a light, soft natural fabric. The fluffy fiber is extracted from the seeds of the cotton plant in a process called ginning. The fiber is then spun into cloth, where it can be woven or knit.

- **Crepe**

Crepe is a lightweight, twisted plain-woven fabric with a rough, bumpy surface that doesn't wrinkle. It is often made from cotton, silk, wool or synthetic fibers, making it a versatile fabric. Due to this, crepe is usually called after its fiber; for example, crepe silk or crepe chiffon.

- **Denim**

Another type of fabric is denim. Denim is a woven cotton twill fabric made from entwined cotton wrap yarn and white cotton stuffing yarn. Denim is mostly dyed with indigo to create blue jeans, but it is also used for jackets and dresses.

- **Lace**

Lace is an elegant, delicate fabric made from looped, twisted or knitted yarn or thread. It was originally made from silk and linen, but lace is now made with cotton thread, wool or synthetic fibers. There are two main elements to lace: the design and the ground fabric, which holds the pattern together. Lace is considered a luxury textile, as it takes time and expertise to create the open-weave design and web-like pattern.

- **Leather**

Leather is a unique type of fabric in that it is made from animal hides or skins, including cows, crocodiles, pigs and lamb. Depending on the animal used, leather will require different treatment techniques. Leather is known for being durable, wrinkle-resistant and stylish.

- **Linen**

The next fabric is linen, which is one of the oldest materials known to humankind. Made from natural fibers, this strong, lightweight fabric comes from the flax plant, which is stronger than cotton. The flax strands are spun into yarn, which is then blended with other fibers.

- **Satin**

Unlike most of the fabrics on this list, satin is not made from a fiber; it is actually one of the three major textile weaves and is made when every strand is well-knitted. Satin was originally made from silk and is now made from polyester, wool and cotton.

- **Silk**

Silk is known as the world's most luxurious natural fabric, silk is another soft, elegant fabric choice with a smooth touch and shimmering look. Silk comes from the silkworm's cocoon.

- **Synthetics**

Nylon is a completely synthetic fiber made up of polymers. It is known for its strength, flexibility and resilience.

Polyester is a man-made synthetic fiber and fabric created from petrochemicals. Though it is strong, durable and wrinkle and stain-resistant, polyester is not breathable and doesn't absorb liquids well.

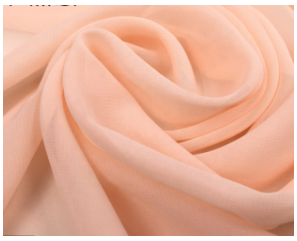
Arguably the most popular synthetic material is spandex, which is made from polyurethane. Also known as Lycra or elastane, spandex is known for its lightweight, elasticity and strength after being blended with several fiber types.

- **Velvet**

Another different type of fabric is the soft, luxurious velvet, which has mostly been associated with royalty due to its rich, opulent finishing and complex production process. Velvet can be made from cotton, linen, cool, silk, nylon or polyester, making it a versatile material that is either inelastic or stretchy. It is often used in blouses, shirts, coats, skirts, evening wear and outerwear.

- **Wool**

Our last different type of fabric is wool. This natural fiber comes from sheep, goat, llama or alpaca fleece. It can be knitted or woven. Wool is often noted for being hairy and itchy, though it keeps the body warm and is durable and long-lasting.


Chifon fabric


Cotton fabric


Crepe fabric


Denim Fabric


Lace Fabric


Leather


Linen fabric


Satin fabric


Silk Fabric

Synthetic Fabric


Velvet Fabric


Wool Fabric

Figure 2.5. Different types of textile fabrics

2.4. Types of textile chemicals

2.4.1. Types of Chemical Used in Textile Industry

There are different types of chemical used in textile processing which are pointed in the below according to their types:

Table 2.1. Different types of chemicals

S.n	Processes	Appropriate Chemicals	s.n	Processes	Appropriate Chemicals
1.	Basic chemicals	• Soda ash • Hydrochloric, • Hydrogen peroxide, • Sulphuric Acid, • Acetic Acid, • Formic acid, • Caustic soda.	2.	Washing agent	• Serafast-CRD, • Kappatex R98, • Seraperse CSN, • Crosden LPD,
3.	scouring agent	• Jintex-GD, • Felosan RGN, • Jintex-GS.	4.	Leveling agent	• Levelex-P, • Jinleve leve-RSPL, • Serabid- MIP,
5.	Salt	• Common Salt, • Glauber Salt.	6.	Sequestering agent	• Resotext 600S, • Heptol-EMG, • Heptol-DBL.
7.	Whitening agent	• Uvitex2B, • Uvitex BHV, • Bluton BBV	8.	Softener	• Cetasaft CS, • Resomine Supper, • Acelon,
9.	Bleaching agent	• 35 % H2O2	10.	Reducing agent	• Hydrose.
11.	Stabilizer	• Stabilizer PSLT, • kappazon H53	12.	Fixing agent:	• Sandofix EC, • Tinofix-ECO, • Protefix-DPE-568,

2.5. Quality parameters of textile materials

Generally to test the quality parameters of woven, knitted and non-woven fabric, the fabric must be conditioning at 24 hours in the standard testing atmosphere. It is very important for all types of fabric.

2.5.1. Quality Parameters of Woven Fabrics

A woven fabric is produced by crossing the two thread systems of warp and weft. The thread crossings is called a woven pattern or weave texture. There are some quality parameters of woven fabric are point out below.

1. Dimensional characteristics:

- Length
- Width
- Thickness.

2. Weight of fabric:

- Weight per unit area.
- Weight per unit length.

3. Fabric strength and extensibility:

- Tensile strength - Tensile strength can be defined as the maximum stress that a material can bear before breaking when it is allowed to be stretched or pulled.
- Tearing strength - Tearing strength is defined (ASTM D1682) as the force required to start or to continue to tear a fabric, in either weft or warp direction, under specified conditions.

4. Threads per inch of fabric:

- Ends per inch - Picks per inch (or p.p.i.) is the number of weft threads per inch of woven fabric. A pick is a single weft thread, hence the term. In general, the higher the picks per inch, the finer the fabric is.
- Picks per inch - Picks per inch (or p.p.i.) is the number of weft threads per inch of woven fabric. A pick is a single weft thread, hence the term. In general, the higher the picks per inch, the finer the fabric is.

5. Yarn count:

- Warp count - The number of warp yarns per one inch or centimeter of fabric. This is also called sley, warp end count, ends per inch, or ends per centimeter.
- Weft count - Here, count refers to the yarn count (warp yarn count and weft yarn count) and by construction primarily it means the number of warp yarns and weft yarns used in one inch of fabric.

6. Crimp:

- Warp crimp - The number of warp yarns per one inch or centimeter of fabric. This is also called sley, warp end count, ends per inch, or ends per centimeter.
- Weft crimp - When warp and weft yarn interlace in fabric they follow a wavy path. This waviness of yarn is called crimp.

7. Handle:

- Stiffness - The ability to resist the bending of fabric is called fabric stiffness. Flexural Rigidity of The Fabric: It is a measure of the resistance of a fabric to bending by external forces.
- Drape - Fabric drape is the term used to describe the way a fabric hangs under its own weight. It has an important bearing on how good a garment looks in use.

8. Crease resistance and crease recovery

Crease resistance is such a property of fabric that resists fabric from creasing. Crease recovery is a fabric property that indicates the ability of fabric to go back to its original position after creasing.

9. Air permeability - Air permeability is defined as the rate of airflow passing perpendicularly through a known area under a prescribed air pressure differential between the two surfaces of a material.

10. Abrasion resistance - Abrasion resistance is the ability of a fabric to resist surface wear caused by flat rubbing contact with another material.

11. **Water resistance** - Waterproof fabrics are fabrics that are, inherently, or have been treated to become, resistant to penetration by water and wetting.

12. Shrinkage - *Fabric shrinkage is* simply the extent to which a piece of fabric changes in length or width during the laundry process**.**

13. Different fastness properties:

- Fastness to light – Light fastness typically means the degree and duration to which dye resists fading due to constant light exposure.
- Fastness to wash - Color fastness to wash is the resistance of a material to change in any of its color characteristics as result of washing with household detergent.
- Fastness to perspiration - Perspiration fastness refers to the ability not to fade and not to stain when dyed fabric is perspired.
- Fastness to Rubbing - Rubbing color fastness refers to ability to sustain original color of dyed fabrics when rubbing.

2.5.2. Quality Parameters of Knitted Fabrics

Knitting is a way of interlocking a series of loops that creates hand and machine knitted fabric. There are some quality parameters of knitted fabric like Strength and extensibility, Course density, Wales density, Lop length, Elasticity, Deformation, Grams per square meter (G.S.M), Yarn count, Design.

2.5.3. Quality Parameters of Nonwoven Fabrics

Nonwoven fabrics, however, miss out on the spinning process and move directly from fibers into fabric using some method to hold the fibers together. Therefore, they do not have as much inherent strength and can, eventually, be pulled, pushed or tugged apart. There are some quality parameters of nonwoven fabric like - Strength and extensibility of fabric, Weight, Thickness, Air permeability, Crease resistance, Stability of washing, Stability of dry cleaning, Dimensional stability, Elasticity.

2.6. The requirements of a textile product

Textile products must be labelled, marked, or accompanied with the required commercial documents in accordance with the most countries Textiles Regulation. Some key examples of the requirements are outlined below.

Labeling and information

→ Manufacturers must ensure that textile products are accurately labelled or marked with an indication of their fibre composition in a durable, easily legible, visible, and accessible way. Any label must be securely attached.

→ Certain products must follow specific labelling provisions should includes particular corsetry products, etch-printed textiles, yarns, velvet and plush textiles (or textiles resembling velvet or plush), and floor coverings and carpets (where the backing and the use-surface are composed of different fibres).

→ Labelling must not be misleading and must be done in a way that a consumer can easily understand.

→ Labelling and markings must be in the official language(s) in which the product is sold.

Self-Check 2	True/False, short answer & Matching

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: True/False questions

1. Wool fibers are obtained naturally from cellulosic plant sources.
2. Silk is an animal origin; the silkworm creates its cocoon from very long silk fibres which are harvested from mulberry trees.
3. Glass fiber is an example of mineral Origin fibers.
4. A woven fabric is produced by crossing the two thread systems of warp and weft.
5. Weft crimp is the number of warp yarns per one inch or centimeter of fabric.

Test II: Short Answer Questions.

1. _____ are natural or synthetic structures that can be spun into yarn and woven, knitted, or bonded into fabric.
2. _____ is a way of interlocking a series of loops that creates hand and machine knitted fabric.
3. _____ are fibers which are occurring in nature; which are originated from of vegetable/plant, animal, and mineral origin.
4. Cotton is a _____; derived from the cellulose fibres surrounding the seeds of the cotton plant.
5. _____ is a plant origin; derived from the cellulose fibres growing inside the stalks of the flax plant.
6. What are the two categories of synthetic fibers with their own examples.
7. _____ are types of man-made fibers in which they are origins from natural cellulosic plants. Examples of regenerated fibers is viscose rayon.
8. _____ are fibers which are man-made origin, and not occurring naturally.
9. Depending on the direction of this final twist, the yarn which are twisted in the counter clock wise direction are _____ and twisted in clock wise direction are _____.

Test III: Matching Questions.

A	***B***
___ 1. Fastness to Rubbing	A. ability to sustain original during laundering
___ 2. Fastness to perspiration	B. ability to sustain original during fatigue
___ 3. Fastness to light	C. the ability not to fade/stain when prespired
___ 4. Fastness to wash	D. ability to sustain constant light exposure

Unit Three: Textile processing methods

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Stages and purposes of textile materials processing
- → Textile products and their end uses
- → Pretreatment chemicals, dyestuffs, printing pastes and auxiliaries for textile processing
- → Quality controlling assessment for textile processes

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Describing Stages and purposes of textile materials processing
- ☺ Identifying textile products and their end uses
- ☺ Applying pretreatment chemicals, dyestuffs and auxiliaries for textile processing
- ☺ Understanding quality controlling assessment for textile processes

3.1. Stages and purposes of textile materials processing

3.1.1. The Different stages of textile Processing

Desizing

Removes the sizing compounds applied to yarns to impart tensile strength. The starch sizing compounds are solubilized with rinsing, alkali, acid or enzyme, and the fabric is washed thoroughly.

Scouring

Removes natural and acquired impurities from fires and fabric. Scouring agents include detergents, soaps, and various assisting agents, such as alkalis, wetting agents, deformers, and lubricants. After scouring, the goods are thoroughly rinsed (or washed) to remove excess agents.

Wool Carbonizing

Removes burrs and other vegetable matter from loose wool or woven fabric goods. The process consists of acid impregnation, baking and mechanical agitation. A dilute solution of sulfuric acid is used to degrade cellulosic impurities to hydrocellulose without damaging the wool.

Bleaching

Bleaching is performed to whiten (remove coloring) the fabric to a high degree. It is a common process used to whiten cotton, wool and some synthetic fibers by removing the natural coloring. It is usually performed after scouring and prior to dyeing or printing.

Mercerizing

Mercerizing is only applied to 100% cotton fabrics and sewing threads. It is used to improve strength, luster and dye affinity, albeit at the expense of extensibility. It is accomplished by the application of a cold solution of sodium hydroxide, causing the fibers to swell and adopt a circular cross-section. The alkali is then removed by an acid wash.

Dyeing

Dyeing is the impartation of color to the textile fiber, yarn, fabric or garment. Among these possibilities fabric dyeing is the most common method in use today because it can be continuous or semi continuous, as well as a batch process.

Printing

Printing is similar to dyeing, except that print color is applied to specific areas of the cloth. Textiles are usually wet-printed by roller, rotary screen or flatbed screen printing methods.

Finishing

The primary purpose of the finishing process is to alter properties affecting the care, comfort, durability, environmental resistance, aesthetic value, and human safety associated with the fabric. Finishes can be applied, for example, to make a fabric wrinkle resistant, crease retentive, water repellant, flame resistant, mothproof, mildew resistant, and/or stain resistant.

3.2. Textile products and their end uses

Clothing - Clothing items for men, women and children. night wear, sportswear, lingerie, undergarments, swimsuit. Accessories such as caps, umbrella, socks, gloves, and handbags.

Furnishing - Upholstery, curtains, draperies, carpets, towels.

Bedding - Bed sheets, blankets, pillows.

Agro textiles - Agro-textiles are used in agriculture, horticulture, aquaculture, landscape gardening and forestry.

Geo textiles - Technical textiles which are used in civil engineering, roads, airfields, railroads, embankments, retaining structures, reservoirs, canals, dams, bank protection, coastal engineering and construction site silt fences, and protection of melting glaciers.

Automotive textiles - Airbags, seat belts, headliners, upholstery, car carpets, and door card.

Medical textiles - implants, sutures, dressings, bandages, medical gowns, face masks.

Indutech - This particular sector includes conveyor belts, drive belts, ropes and cordages, filtration products, glass battery separators, decatising and bolting cloth, AGM (absorption glass mat) plasma screens, coated abrasives, composite materials, printed circuit boards, printer ribbon, seals, gaskets, paper making fabrics.

3.3. Pretreatment chemicals, dyestuffs, printing pastes and auxiliaries for textile processing

Natural textiles can include material such as wool, flax, silk, cotton, bamboo and hemp and synthetic includes such materials as acrylic, nylon, rayon, spandex and polyester.

3.3.1. Lists of Chemical Used in Textile pretreatment

There are different types of chemical used in textile pretreatment which are pointed in the below according to their types:

- **Caustic soda** - today, caustic soda is widely used in the textile industry for processes such as scouring, mercerization and dyeing, integral parts of the textile manufacturing process.
- **Soda ash** - Soda ash changes the pH of the fiber.

- **Hydrochloric acid** - it is used to neutralise alkaline residues in cotton in the cleaning process immediately prior to bleaching.
- **Hydrogen peroxide** - The textile bleaching process that involves hot hydrogen peroxide (H2O2) solution is commonly practised in cotton fabric manufacture.
- **Sulphuric Acid** – sulphuric acid is used for desizing process of cotton fabrics.
- **Acetic Acid** - The textile industry also uses acetic acid. It is used in fabric dyeing, as well as for the production of rayon and most latex and artificial fabrics.
- **Formic acid** - In textile processing formic acid is mainly used for efficient pH regulation.

3.3.2. Lists of Chemical Used in Textile dyeing operation

Dyestuff - substance used to impart colour to textiles, paper, leather, and other materials such that the colouring is not readily altered by washing, heat, light, or other factors to which the material is likely to be exposed. According to their nuclear makeup, dyes can be anionic or cationic. Some types of synthetic dyes include:

Table 3.1. Dye stuffs and their end-uses

Type of Dyestuff	Purpose
Acid dyes	Acid-based dyes are used mostly on nylons and wool.
Sulfur dyes	These dyes are combines with caustic soda and water to color clothing, but they lighten quickly.
Reactive dyes	These dyes only dye clothing as a reaction to certain fibers, and are best used on silk, wool, and acrylics.
Azoic dyes	Lighter colored dyes that fade quickly but are cheap to use.
Mordent	this is a chrome based dye that has to be blended with different types of acid to color wools and cotton.
Vat	these dyes are require four steps of processing, starting off in a vat, and then being combined with certain chemicals.
Disperse dyes	Used for dyeing of synthetic fibers like polyester, nylon

3.3.3. Lists of Chemical Used in Textile printing operation

The Basic Ingredients of Printing are as follows:

a) Pigments

Pigments consist of excellent particles of ground coloring matter suspended in liquid which forms a paint film that bonds to the surface it is applied to.

b) Thickener

Thickener gives the required viscosity to the printing paste; prevents premature reactions between the chemicals in the print paste.

c) Carriers and swelling agents

These are used to accelerate the rate of dye penetration by fibre polymer, swell the fibre and reduce crystalinity.

d) Solvents or solution acids or dispersing agents

This prevents aggregation of the dyestuff molecules in the highly concentrated paste of the dye; solution aids increase the solubility of insoluble dyestuff.

e) De-foaming agents

De-foaming agents prevent the formation of foam during printing. E.g. silicone de-foamers, sulphated oil etc.

f) Wetting agents

Substances that reduce the surface tension of water, thereby allowing it to wet a surface easily, which are otherwise non-wettable, are known as wetting agents.

3.3.4. Lists of Chemical Used in Textile finishing operation

Chemical finishes can be durable or non-durable and different chemicals will bind at different strengths to different fibres. These can include:

Table 3.2. Finishing processes and their appropriate chemicals

Finishing Process	Chemicals used
Crease resistant finish	Formaldehyde, citric acid
Anti-Microbial finish	Phenols, quaternary ammonium compounds, organo-silver
Hydrophilic finishes	Oxy-ethylated polyamides
Anti-static finishes	Silicone, poly ammonium quaternary salts
Non-slip finishes	Silica gel
Fire resistant finishes	Brominated flame retardants, Chlorinated flame retardants, Phosphorous-containing flame r Formaldehyde etardants

Easy care finish	Formaldehyde

3.3.5. Processing of Pretreatment chemicals

The dyeing of a textile fibre is carried out in a solution, generally aqueous, known as the dye liquor or dye-bath. For true dyeing (as opposed to mere staining) to have taken place, the coloration must be relatively permanent—that is, not readily removed by rinsing in water or by normal washing procedures. Moreover, the dyeing must not fade rapidly on exposure to light. The process of attachment of the dye molecule to the fibre is one of absorption; that is, the dye molecules concentrate on the fibre surface.

3.4. Quality controlling assessment for textile processes

3.4.1. Importance of Textile Testing

The testing of textile products is an expensive business. A laboratory has to be set up and furnished with a range of test equipment. Trained operatives have to be employed whose salaries have to be paid throughout the year, not just when results are required. Moreover all these costs are nonproductive and therefore add to the final cost of the product. Therefore it is important that testing is not undertaken without adding some benefit to the final product.

Table 3.1. Different types of chemicals

3.4.2. Reasons for Textile Testing

a) Checking Raw Materials

The textile industry consists of a number of separate processes such as natural fiber production, man-made fiber extrusion, wool scouring, yarn spinning, weaving, dyeing and finishing, knitting, garment manufacture and production of household and technical products. The incoming material is checked for the required properties so that unsuitable material can be rejected or appropriate adjustments made to the production conditions. The standards that the raw material has to meet must be set at a realistic level. If the standards are set too high then material will be rejected that is good enough for the end use, and if they are set too low then large amounts of inferior material will go forward into production.

b) Monitoring Production

Production monitoring, which involves testing samples taken from the production line, is known as quality control. Its aim is to maintain, within known tolerances, certain specified properties of the product at the level at which they have been set.

c) Assessing the Final Product

In this process the bulk production is examined before delivery to the customer to see if it meets the specifications. In some cases selected samples are tested and in other cases all the material is checked and steps taken to rectify faults.

d) Investigation of Faulty Material

If faulty material is discovered either at final inspection or through a customer complaint it is important that the cause is isolated. This enables steps to be taken to eliminate faulty production in future and so provide a better quality product.

e) Product Development and Research

In the textile industry technology is changing all the time, bringing modified materials or different methods of production. Before any modified product reaches the market place it is necessary to test the material to check that the properties have been improved or have not been degraded by faster production methods. In this way an improved product or a lower-cost product with the same properties can be provided for the customer.

Self-Check 3	Short answer questions

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: Short Answer Questions.

1. _____ removes the sizing compounds applied to yarns to impart tensile strength. a) sizing b) bleaching c) scouring d) dyeing
2. _____ removes natural and acquired impurities from fires and fabric. a) sizing b) bleaching c) scouring d) dyeing
3. _____ removes burrs and other vegetable matter from loose wool or woven fabric goods. a) sizing b) carbonizing c) scouring d) dyeing
4. _____ is performed to whiten (remove coloring) the fabric to a high degree. a) sizing b) bleaching c) scouring d) dyeing
5. _____ is only applied to 100% cotton fabrics and sewing threads to improve strength, luster and dye affinity, albeit at the expense of extensibility. a) mercerizing b) bleaching c) scouring d) dyeing
6. _____ is the impartation of color to the textile fiber, yarn, fabric or garment. a) sizing b) bleaching c) scouring d) dyeing
7. _____ is similar to dyeing, except that the color is applied to specific areas of the cloth. a) printing b) bleaching c) scouring d) dyeing
8. _____ is widely used in the textile industry for processes such as scouring, mercerization and dyeing, integral parts of the textile manufacturing process. a) caustic soda b) peroxide c) dyestuff d) pigment
9. _____ substance are used to impart color to textiles, paper, leather, and other materials. a) sizing chemicals b) bleaching chemicals c) scouring chemicals d) dye stuffs
10. What the Basic Ingredients for the formation of a Printing paste.

_____

_____

_____

_____

_____

_____

11. List out the reasons for Textile Testing

_____

_____

_____

_____

_____

12. What is the importance of Textile Testing

Unit Four: Handle and store materials

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- → Safety procedures and work practices
- → Load lifting equipment and techniques
- → Handling of materials assistance
- → Storing of materials and products

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- ☺ Following safety procedures and work practices
- ☺ Using load lifting equipment and techniques
- ☺ Observing and using handling materials assistance
- ☺ Performing storing of materials and products

4.1. Safety procedures and work practices

4.1.1. What is Safety Procedures

Work place safety procedures are standardized processes that outline how to conduct tasks with minimal risk to people, materials, and work environments.

4.1.2. Types of Safety Procedures

a) Exposure to cotton dust: The workers engaged in the processing and spinning of cotton are exposed to significant amounts of cotton dust. The fatal disease of byssinosis, commonly known as brown lung, is caused among people working in the textile industry on account of excessive exposure to cotton or jute dust. The symptoms of this disease include tightening of the chest, coughing, wheezing and shortness of breath.

b) Exposure to chemicals: Workers in the textile industry are also exposed to a number of chemicals, especially those engaged in the activities of dyeing, printing and finishing which can result in skin irritation, blindness, respiratory system irritation, corrosion, and explosions.

c) Exposure to noise: High levels of noise have been observed in most of the units engaged in the textile industry, particularly those in developing countries. In the long run, exposure to high noise levels has been known to damage the eardrum and cause hearing loss.

d) Ergonomic: Ergonomic hazards are physical factors that damage the employees' musculoskeletal system. Examples include overly repetitive movements, uncomfortable seats that result in poor posture, and poorly set up workstations.

4.1.3. Work practices

Safe work practices are generally written methods outlining how to perform a task with minimum risk to people, equipment, materials, environment, and processes.

All safe work practices should be kept in a location central to the work being performed and readily available to the workforce.

4.2. Load lifting equipment and techniques

Load shifting generally refers to the operation of front-end loaders, excavators and dozers. Less common forms of load shifting are the operation of cableways and flying foxes and draglines.

4.2.1. Techniques for operating load shifting equipment according to the procedures

- Read technical manuals to understand equipment and controls
- Disassemble machinery and equipment when there is a problem
- Repair or replace broken or malfunctioning components

- Perform tests and run initial batches to make sure that the machine is running smoothly
- Adjust and calibrate equipment and machinery to optimal specifications.

Put sequence operations to carryout load shifting

To carry out load shifting equipment the operation should be performed sequentially. According to the load, type and handling methods.

Use load shifting balance

The most common load shift equipment

- For vertical direction (up and down) - Block and tackle, Elevators, Pillar crane
- For transport devices - Wheel barrows, Hand and power trucks, Industrial narrow railways tractors, Pipe lines, Carts and trolleys
- Lifting and transport - Hoists with trolleys running on overhead rails, forklifts truck, Crone trucks, Front end loader / backhoe

4.3. Handling of materials assistance

4.3.1. Material Handling Equipment

is mechanical equipment used for the movement, storage, control, and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption, and disposal. The different types of equipment can be classified into four major categories: transport equipment, positioning equipment, unit load formation equipment, and storage equipment.

a) Transport equipment

Transport equipment is used to move material from one location to another (e.g., between workplaces, between a loading dock and a storage area, etc.), while positioning equipment is used to manipulate material at a single location. The major subcategories of transport equipment are conveyors, cranes, and industrial trucks. Material can also be transported manually using no equipment.

Conveyors

Conveyors are used when material is to be moved frequently between specific points over a fixed path and when there is a sufficient flow volume to justify the fixed conveyor investment. Accumulation allows intermittent movement of each unit of material transported along the conveyor, while all units move simultaneously on conveyors without accumulation capability.

Cranes

Cranes are used to transport loads over variable (horizontal and vertical) paths within a restricted area and when there is insufficient flow volume such that the use of a conveyor cannot be justified.

Industrial trucks

Industrial trucks are trucks that are not licensed to travel on public roads (commercial trucks are licensed to travel on public road. Industrial trucks are used to move materials over variable paths and 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 because there are no restrictions on the area covered, and they provide vertical movement if the truck has lifting capabilities. Forklifts are one of the best examples of industrial trucks.

Hand trucks

Hand trucks are the simplest type of industrial truck, cannot transport or stack pallets, is non-powered, and requires the operator to walk. A pallet jack, which cannot stack a pallet, uses front wheels mounted inside the end of forks that extend to the floor as the pallet is only lifted enough to clear the floor for subsequent travel.

Yard ramp

A yard ramp, sometimes called a mobile yard ramp, is a movable metal ramp for loading and unloading of vehicles. A yard ramp is placed at the back of a vehicle to provide access for forklifts to ascend the ramp. Using a yard ramp for vehicle loading or unloading allows the work to be carried out by a forklift.

Conveyer belt *Jib crane* Forklift *Hand trucks* *Mobile yard ramp*

Figure 4.1. Transport equipments

b) Positioning equipment

Positioning equipment is used to handle material at a single location. It can be used at a workplace to feed, orient, load/unload, or otherwise manipulate materials so that are in the correct position for subsequent handling, machining, transport, or storage.

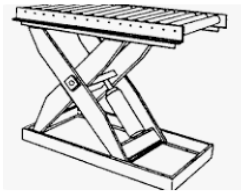


Figure 4.2. positioning equipment

c) Unit load formation equipment

Unit load formation equipment is used to restrict materials so that they maintain their integrity when handled a single load during transport and for storage. If materials are self-restraining (e.g., a single part or interlocking parts), then they can be formed into a unit load with no equipment. Examples include pallets.

Figure 4.3. Four-way pallet

d) Storage equipment

Storage equipment is used for holding or buffering materials over a period of time. The design of each type of storage equipment, along with its use in warehouse design, represents a trade-off between minimizing handling costs, by making material easily accessible, and maximizing the utilization of space (or cube).

Figure 4.4. Single-deep pallet racks

4.4. Storing of materials and products

4.4.1. Textile Storage

Textile storage means the techniques that take care of the materials by maintaining its original state and preserving it for the future. There are some basic guidelines of storage which need to be followed to prevent the textiles from deterioration. Firstly, before storing the garments, make sure they are clean.

Most of the time the main cause of textile damage is the environment in which they are stored. Hence, prolonged exposure to direct sunlight or fluorescent lights must be avoided. Also, avoid storing textiles in the basement or loft.

Figure 4.5: Textile storing

It is best to maintain the temperature at 65-70°F and humidity at 50-55%. To maintain this temperature, air conditioning and central heating systems can be used. A slight fluctuation in the temperature is allowed as long as it is gradual. There are three basic types of textile storage. They are Flat, Rolled and hanging storage.

c) **Flat storage** is an ideal method for delicate, painted and extraordinary textiles as it gives leveled support to the fabrics. Metal or wooden drawer or even acid free boxes can be used to store the textiles flat.

d) **Rolled storage** is the best technique for textiles which are very large like tapestries, long curtains, carpets and quilts. It also saves space while storing large textiles. One must have seen how textiles are rolled and stored in fabric stores.

e) **Hanging storage** - for some dresses flat storage will not work because it will bring creases on the clothes. Thus, the best method to store the clothes without forming any creases is hanging them.

Self-Check 4	Short answer questions

Name _____ ***I.D*** _____ ***Date*** _____

Directions: Answer all the questions listed below.

Test I: Short Answer Questions.

1. _____ are standardized processes that outline how to conduct tasks with minimal risk to people, materials, and work environments.
2. _____ are physical factors that damage the employees' musculoskeletal system.
3. _____ are generally written methods outlining how to perform a task with minimum risk to people, equipment, materials, environment, and processes.
4. List out the types of Safety Procedures

   _____

   _____

   _____

   _____
5. _____ Load shifting generally refers to the operation of front-end loaders, excavators and dozers.
6. _____ is mechanical equipment used for the movement, storage, control, and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption, and disposal.
7. _____ is used to move material from one location to another.
8. _____ are used when material is to be moved frequently between specific points over a fixed path and when there is a sufficient flow volume to justify the fixed conveyor investment.
9. What is the effect of exposure to cotton dust during excessive exposure to cotton or jute dust.

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