DRAFT STUDY MATERIAL

JUTE PRODUCT ARTISAN

(Qualification Pack: Ref. Id. AMH/Q7405)
Sector: Apparel, Made-ups & Home Furnishing

(Grade XI)

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(A constituent unit of NCERT, under MOE, Government of India)
Shyamla Hills, Bhopal- 462 002, M.P., India
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Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives.

The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material.

Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material.

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20 June 2024

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Module 1	Introduction to Fibers, Yarns and Fabrics

Module Overview

Fiber, yarn, and textile are widely used by human beings in their day-to-day life. These materials cater the clothing industry, home-textile industry, medical industry, other products and industrial fabrication. Fiber is the fundamental unit to create fabrics. Fibers are classified under different categories, like their origin, properties etc. When more than one fiber is twisted together, during the process of spinning, the resultant product is called ~~as~~ Yarn. Sometimes blend of different fibers are used to produce blended yarn to increase the fabric performance, to maintain the economical price etc. Compact arrangement of yarn is known as fabric and can be either woven, knitted or non-woven. Weaving is the process where two sets of yarn are interlaced at the right angle with each other to produce fabric. Weaves can be of different types like plain, dobby, satin etc. Knitting is the process of interloping of yarn with the loop of another type or similar yarn. Non-woven fabrics are made directly from fiber and not yarn; hence the process of spinning and weaving is not required. Depending on the usage or functionality of the fabric, they can be classified as consumer textiles and technical textiles. Clothing, bags, carpets, etc. are grouped together under consumer textiles. On the other hand, medical textiles, geotextiles, industrial textiles form part of technical textiles. In the recent times, technical textiles are fast catching up and lot of research and development is going on to improve it further.

Learning Outcomes
After completing this module, you will be able to: • Identify and classify fibres, and describe its properties • Identify, define and classify yarns and factors affecting them • Define and describe fabric properties, and factors affecting fabric properties
Module Structure
Session 1: Identify and classify fibers, and describe its properties
Session 2: Identify, define and classify yarns and factors affecting them
Session 3: Define and describe fabric properties, and factors affecting fabric properties

Session 1: Identify and Classify Fibers and Describe Its Properties

FIBER

Fibre is the smallest unit of any textile material. These are fine hair like substance which are very small in diameter and can be converted into yarns and later into fabrics as per the requirement of the end products.

Fig. 1.1 Fibre to Fabric

Fibres possesses a wide range of properties which are useful for merchandise like textiles, clothes, bed-lines, accessories, and other industrial products. These qualities are the base to select the fibre to make yarns and further fabrics.

Fiber properties

Fibres can be of different types, but not all fibres can be classified as textile fibres. Human hair, a type of fibre that cannot be classified as textile fibre, as it does not possess all the characteristics of a textile fibre. For any fiber to be classified as textile fiber it should have certain characteristics. Their characteristics can be classified under two headings, essential or **primary properties** and desirable or **secondary properties.**

- **Primary properties:** These properties are vital, in order for a fiber to be grouped under a textile fiber. These can be classified as:
  - **a. Fiber length to width ratio:** In order for a fiber to be converted into a yarn, it should have an adequate length. Fiber diameter should be minimum 1/100 of its length. This is crucial for the spinning process of making yarn.
  - **b. Strength or Tenacity:** Spinning, weaving and knitting exert force on the fiber so strength or tenacity of the fiber is an important attribute for the fiber to be processed on machine. It is directly proportional to the force required to rupture or break the fiber.
  - **c. Flexibility or pliability:** It is ability of the fiber to move freely during handling without breakage or bursting. Textile fibers should be pliable so that threads can adjust to each other while spinning. Pliability is also required for good fall in the resulted fabric.

d. **Fiber uniformity:** The individual fiber needs to be uniform or even in its length and diameter. The natural fibers are sorted and graded on how asymmetrical or uneven they are in their length, for yarn making. Irregular fibers are weak, rough and unsuitable for textile usage.

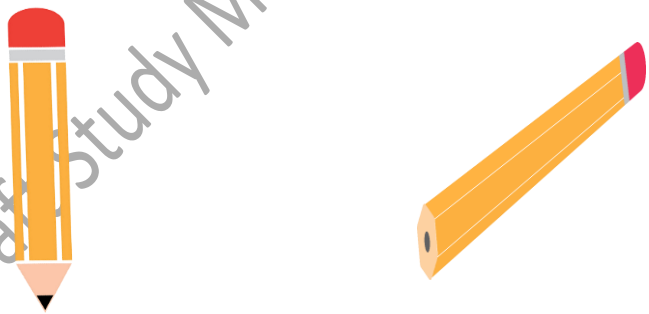
e. **Cohesiveness:** It is the property of the fibers to stick to each other during manufacturing of yarn. The shape and surface of the fiber regulates the cohesiveness.

- **Secondary properties:** In addition to the primary properties, the performance of textile fiber is also dependent on some physical, chemical and environmental properties. The appearance, durability, comfort and maintenance of the fabric manufactured from them are influenced or dependent on them. These properties can be classified as:

a. Physical properties:

- **Morphology** – It describes the form or shape of the fiber and can only be studied under a microscope as the fibers are very fine.
  - **Longitudinal view**: It is the view in lengthwise direction.
  - **Cross section view**: It is the view when fiber is cut in width or breadth like a pipe.

Taking an example of a pencil what you see along its length is the longitudinal or lengthwise view and the cross-sectional view is seen when we cut a circular ~~slice~~ piece from it.



(a) ross-sectional view *(b) longitudinal view*

Fig: 1.2 (a & b) Morphology

- **Luster:** This is referred to as the glossiness, sheen or shine that fibers possess naturally and is visible when light is reflected from the surface. The fabrics that are made from filament fibers are more lustrous.

- **Colour:** The climatic condition, soil type and environmental factors have an influence on the colour that natural fibers depict. Natural fibers possess colours like off-white and yellowish.

- **Elasticity and elastic recovery:** Elasticity is referred to the fiber ability to stretch before it breaks. Recovery is the ability of a fiber to return to its original length after being stretched.
- **Moisture absorption:** The ability of the fiber to absorb water from the atmosphere, defines the comfort level of the fabric.
- **Resiliency:** It is ability of the fiber to bounce to its original shape after bending or creasing.
- **Abrasion:** Wear and tear of the material when it rubs against another surface is called as abrasion. It should be ensured that the fiber must be able to sustain force without it getting damage.
- **Thermal properties:** The thermal properties of the fiber are its reaction to heat and flame.
- **Static electricity:** This is the ability of the fiber to transfer or conduct electric charges through it. Static charge generates when the fiber rubs against each other or against other fabric or surface. It has been observed that static charge is more in fibers that have low moisture absorbency.

b. Chemical properties:

- **Effect of acids:** Fibers made from cellulose and wool get easily damaged or destroyed by concentrated, cold or dilute hot mineral acid like sulphuric acid. On the other hand, the wool fiber is not affected by other type of acids.
- **Effect of alkali:** Unlike fibers made from cellulose, fibers made from protein get easily damaged by alkali. Thus, the selection of detergent is very important for different type of fibers.
- **Effect of Sunlight:** Strong and prolonged exposure to sunlight have an adverse effect on certain fibers. This exposure causes the fibers to turn yellow or get permanently damage.

c. Biological Properties – Fungi (mildew) bacteria, beetles, moths, insects and silverfish have an adverse effect on certain fibers. Thus, it is very important for fabric made from these fibers to be properly stored and cared. Wool and silk are very sensitive fiber with regard to moth attack.

Classification of Textile Fibers

Textile fibers are classified on the basis of:

1. **Origin of fiber-** Based on the raw material used to make them i.e., from natural resources and manufactured by man.
2. **Length of fibers** – Length of the fibers also can be used to classify them i.e., short/**staple fibers** and long/**filament fibers**.

Man-made fiber, can have any length, depending on its requirement. On the other hand, natural fibers, except for silk fibers, are short in length. Man-made fibers are also referred to as filament fibers.

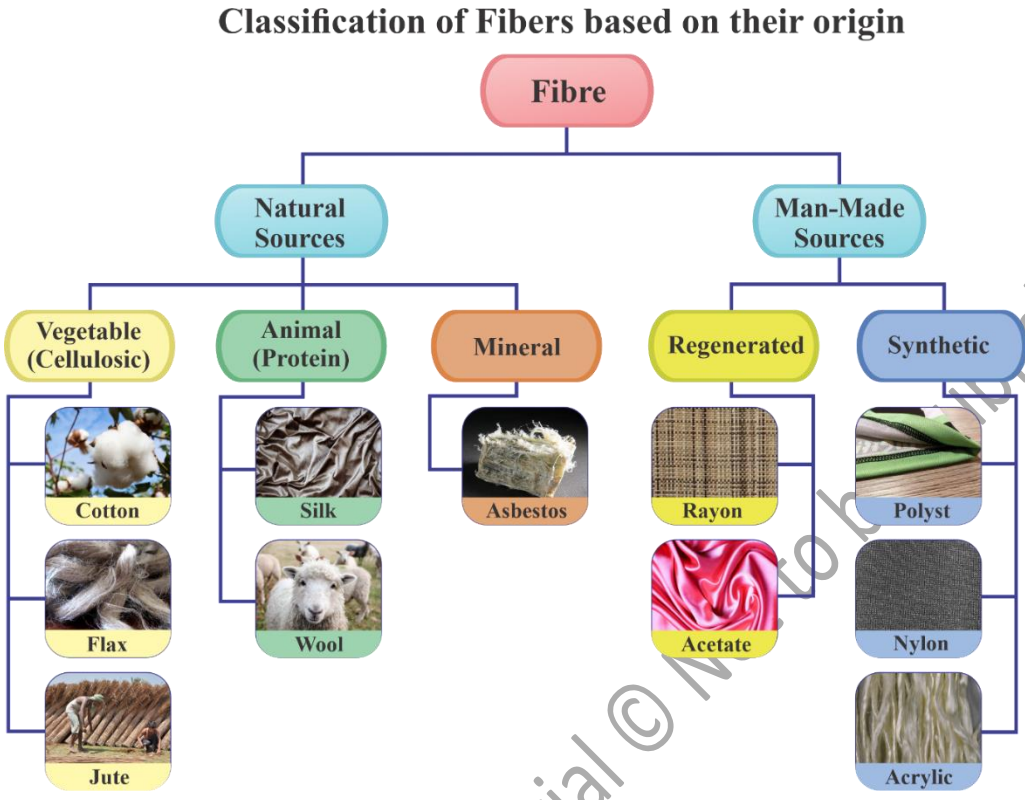
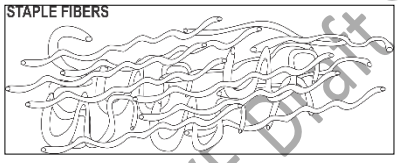
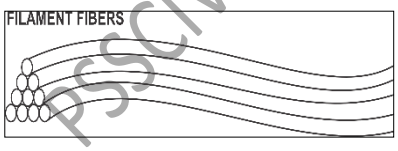


Fig: 1.3 Classification of Fibers based on their origin

Table 1.1: Classification of fibers based on the length of the fibers

Type of fibers based on length	Characteristics	Examples
	Short length Measured in inches	Cotton, Jute, Wool
	Long continuous length Measured in yards or meter.	Silk and man-made fibers such as Polyester, Rayon, Acrylic

Natural Fibers

In nature variety of fibrous materials are available. Some of them that are used to make fabrics are classified under textile fibers. Those that are obtained from natural sources such as animals, plants and minerals and are classified as **natural fibers**.

All the constituent of this group, differ from each other on the basis of their source of origin and chemical composition. These in turn, have an impact on their properties and their end use. Depending upon the source they are categorized as:

1. Cellulosic fibers / Vegetable fibers
2. Protein fibers / Animal fibers
3. Mineral fibers

Cotton, jute and flax are some of the examples of cellulosic fibers and are obtained from different parts of the plants. Unlike cotton fiber which is obtained from seeds, the jute and flax fibers are obtained from the stem of the plant. Protein fiber such as wool is obtained from different animals that have hair on their body (sheep, goat, camel, and rabbit) and silk is sourced from silkworm's saliva. As animal fibers contains protein, hence they are also referred as protein fibers. Mineral fibers such as asbestos are obtained through mining.

Man-made Fibers

Fibers that are manufactured by using different chemicals are called **man-made fibers**. They can be produced into filament of any desirable length. This group of fibers can further be categorized under three sub-categories depending upon their raw material-

1. Regenerated fibers – the raw material is cellulose like wood pulp or waste small cotton fibers (cotton linters). By treating this with chemicals, a new fiber is developed and is known as "regenerated fiber"**,** e.g. rayon and acetate.
2. Synthetic fibers – These fibers are produced by using different types of chemicals under controlled conditions, for example, nylon and polyester.
3. Other fibers - metallic fibers like gold, silver and metals or metal coated on plastic fibers.

Properties of Natural Fibers

Natural fibers such as cotton, linen, jute, silk and wool are largely used as textile fibers. These fibers lack uniformity as they are grown in climatic conditions and soil. Due to variance in composition, the properties of these fibers are different from each other.

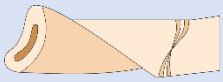
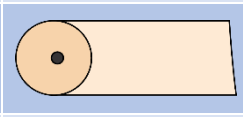
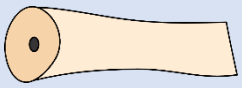
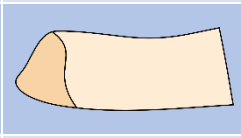
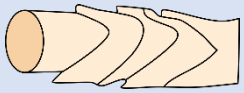
Essential properties that are necessary for a fiber to be classified as a textile fiber are called as primary properties. Whereas, secondary properties are considered as desirable properties. These properties can be further categorised as morphological, physical, chemical and biological properties.

Morphology

Morphology or structure, shape and size of the fiber has an impact on their characterstics and performance. For example, if the requirement is of fine fabric, a coarser yarn like wool can~~n~~'t be used. These characteristics also affect other

properties too, such as rod-like structure of the silk fiber is the reason behind lustre of the silk fabric. Let's understand how these fibers differ from each other (Table 1.2).

Table 1.2: Morphology of Natural Fibers

FIBER		MORPHOLOGY		
		Cross Sectional & Longitudinal View	***Diameter***	***Length***
Cellulosic Fibers	**Cotton**		12 – 20 microns	½ to 2½ inches
	Flax		Width varies, 1/1200 of an inch	A few inches - 22 inches or more
	Jute		Irregular diameter	5 to 20 feet long
Protein Fibers	**Silk**		9 -11 microns	1000 – 1300 yards
	Wool		15 – 70 microns	1 ½ to 15 inches
Mineral Fibers	**Asbestos**	-----	Too fine to measure	>1 cm

- **Micron = 0.0005 mm**

Physical Properties

Physical properties such as colour, lusture, strength, elasticity, resiliency, absorbency and dimensional stability, help us to decide the end use of the fiber. They also contribute to the appearance of the fabric. Let's study the physical properties of the natural fibers (Table 1.3).

Table 1.3: Physical Properties of Natural Fibers

FIBER		PHYSICAL PROPERTIES						
		Colour	***Lustre***	***Strength***	***Elasticity***	***Resiliency***	***Absorbency***	***Dimensional Stability***
Cellulosic Fibers	**Cotton**	White to grey to off white	Low	Good	Low	Low. Wrinkles easily	High	Relatively stable
	Flax	Light ivory to dark grey	High natural lustre	High	Low	Low. Prone to wrinkle	High	High
	Jute	Yellow to brown	Silky	High	Very low	Low	Low	Good

Protein Fibers	**Silk**	White to cream to tan	High natural lustre	Strongest natural fiber	Good	Medium. Creases go away slowly	High	Good
	Wool	Yellowish-white or ivory	Low	Weak	Excellent	Excellent	High	Subject to shrinkage
Mineral Fibers	**Asbestos**	white, pale green, yellow and blue	High	High	Poor	-	Poor	-

Chemical Properties

Through chemical properties, we analyse the effect of acids, alkalies, organic solvents and sunlight on the fiber, which further, affect the care and maintenance of the fabrics or other products.

Table 1.4: Chemical Properties of Natural Fibers

FIBER		CHEMICAL PROPERTIES		
		Effect of Alkalies	***Effect of Acids***	***Effect of Sunlight and other factors***
Cellulosic Fibers	**Cotton**	Resistant, no harmful effects	Weaken and degrade fiber	Turns Yellow in sunlight, prolonged exposure weaken fiber
	Flax	High resistance	Resistant to mild acids. Strong acids damage them.	No Effect
	Jute	Resistant	Resistant to mild acids. Strong acids damage them.	No Effect
Protein Fibers	**Silk**	Strong alkalies damage fiber.	Gets damaged in mineral acids, organic acids do not damage.	Prolonged exposure causes breakdown
	Wool	Low resistance, destroy fiber	Good to dilute acids. Medium to poor resistance strong acids.	Prolonged exposure deteriorates fiber

Biological Properties

Biological properties includes effect of micro-organisms (bacteria and fungi) and insects on textile fibers. This property is generally associated with the process of storing fabric (Table 1.5).

Table 1.5: Biological Properties of Natural Fibers

FIBER		BIOLOGICAL PROPERTIES	
		Effect of Micro organisms	***Effect of Insects***
Cellulosic Fibers	**Cotton**	Mildew (fungi) damages	Silverfish damage cotton
	Flax	Mildew will grow and damage	Resistance
	Jute	Resistance	Resistance

Protein Fibers	**Silk**	Good resistance	Destroyed by carpet beetles
	Wool	Resistance really good	Moths and carpet beetles damage

Activities

Activity 1:

Prepare an illustrative info graphic on various fibers and their properties

Materials Required:

1. Colored sheets
2. A4 size papers
3. Pen, pencils and colored pens
4. Eraser
5. Sharpener
6. Ruler
7. Different samples of fibers

Procedure:

1. Collect the required information, pictures and fiber samples.
2. Ask your teacher about info graphic and how to make it.

Organize the collected information in the form of an infographic.

Check Your Progress

True Or Faslse

1. Cotton, jute, and wool are examples of short-length natural fibers. (True/False)
2. The primary properties of textile fibers include fiber length to width ratio, strength or tenacity, and flexibility. (True/False)
3. Weaving is a process where two sets of yarn are interlaced at the right angle to produce fabric. (True/False)
4. Luster refers to the glossiness, sheen, or shine that fibers possess naturally. (True/False)

5. Regenerated fibers, such as rayon and acetate, are categorized under man-made fibers. (True/False)

Fill in the Blanks

1. _____is a protein fiber obtained from the saliva of silkworms.
2. The color of cotton fibers can be influenced by climatic conditions, soil type, and _____factors.
3. Wool has low _____to strong acids, making it susceptible to damage.
4. The ability of a fiber to return to its original length after being stretched is known as_____.
5. Natural fibers, such as_____ and _____, are classified based on their length as short/staple fibers and long/filament fibers.

Question Answers

1) What are the essential properties of fibers?
2) Name the desirable properties of fibers?
3) What are different types of natural fibers? Give some examples of each.
4) What is man-made fibers? Please give examples of different categories of these fibers.
5) What are biological properties of fiber? Why are they important?

Session 2: Identify, Define and Classify Yarns and Factors Affecting Them

Yarn

Yarn is a broad terminology when two or more fibers are laid or twisted together, having a significant length and relatively small cross-section. Further, it is a finish product of a spinning and winding process. Process of making yarn from fibers is known as Spinning**.** To manufacture yarn from staple fibers, a bundle of fibers is taken, cleaned and straightened. After the cleaning and straightening process, the fibers are pulled out drawn and a twist is given to hold them together. This process is called mechanical spinning and is suitable for natural fibers like cotton and wool. The resultant yarn is a spun yarn. The filament yarns are spun by the chemical spinning process. In this process, spinning solution of the raw materials is made and passed through the holes of a spinnerets. The solution on solidification takes thread like form called the filament fiber. These filament fibers are twisted together to form a strong and fine yarn.

Classification of Yarns according to Length

A yarn is an intermediate product that is made from fibers and is used to manufacture fabrics. Yarns can be made either from short staple length fibers or from filament fibers. There are two types of yarns, i.e., spun yarns and filament yarns (Fig 1.4).

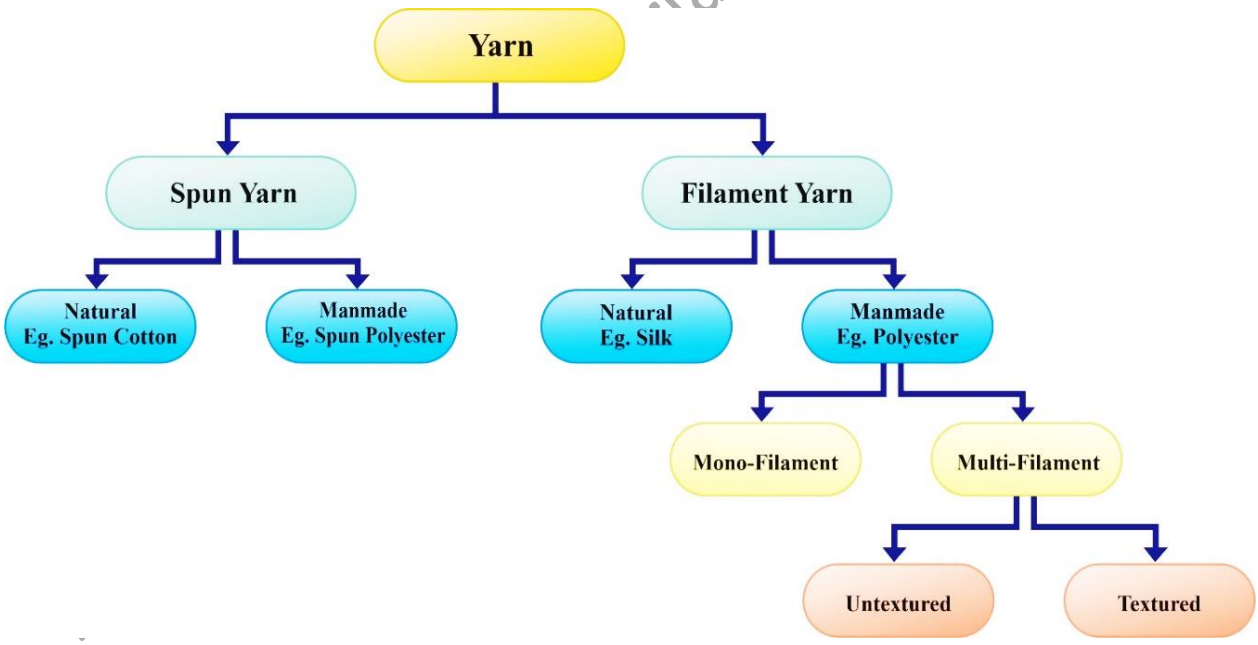


Fig. 1.4: Classification of Yarns according to Length

- **Spun Yarn** – It consist of staple fibers assembled and held together by twist. Unlike all natural fibers which are staple in length, silk is a filament fiber. Manmade fibers are made staple by cutting them into short lengths (Fig1.5).

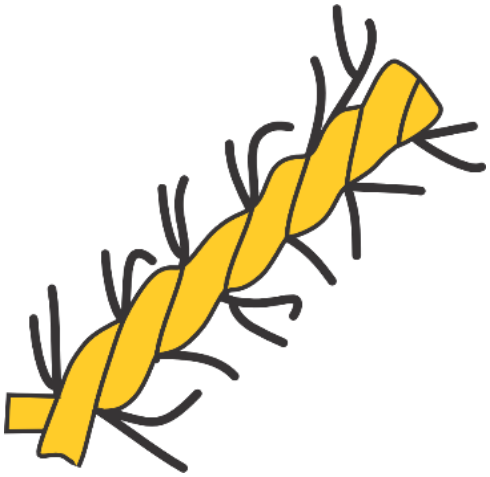
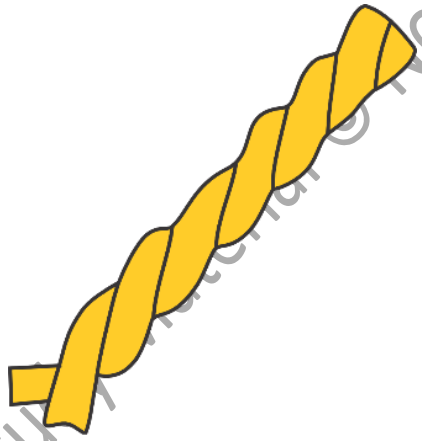
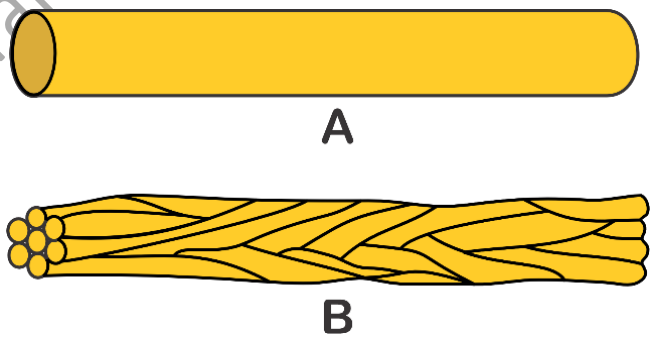


Fig. 1.5: Spun Yarn

- **Filament Yarn –** These are long continuous fiber strands that have indefinite length. They can be either *monofilament* (one fiber) or *multifilament* (a no. of filaments). Filaments may be smooth or textured (crimped in some way) (Fig 1.6).



(a) Filament Yarn



(b) A. Mono Filament Yarn B. Multi Filament Yarn

Fig. 1.6: (a) Filament Yarn & (b) A. Mono Filament Yarn B. Multi Filament Yarn

Now, let's look at the major differences between spun yarn and filament yarn from Table 1.6:

Table 1.6: Spun Yarn vs. Filament Yarn

SPUN YARN	FILAMENT YARN
➢ Short fibers twisted into continuous strand has protruding ends ➢ Dull fuzzy look ➢ Good absorbency	➢ Long continuous, Smooth, closely packed strand ➢ Smooth, Lustrous ➢ Poor absorbency

Classification of Yarns according to Yarn Structure

Yarns may be classified as simple and complex or novelty yarns.

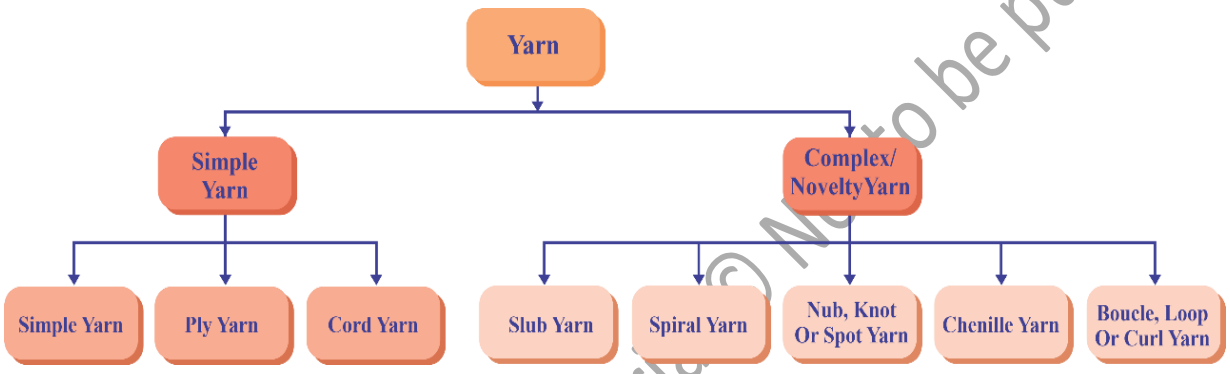


Fig. 1.7: Classification of Yarn according to Yarn Structure

- **Simple Yarn**

A simple yarn is regular and symmetrical throughout. A novelty yarn has unlike parts; it is irregular at regular intervals. Simple yarns are classified as single, ply and cord.

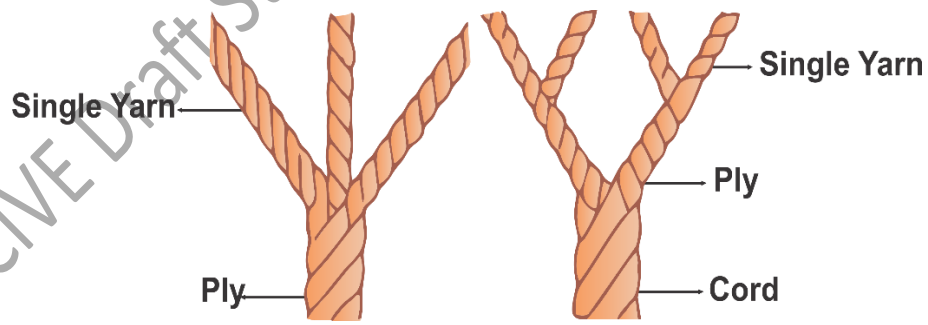


Fig. 1.8: Single, ply and cord

A Single yarn is produced due to the first twisting operation that is performed by the spinning machine.

A ply yarn is made when two or more single yarn are combined and a second twisting operation is completed. Each part of the yarn is called a ply. For example, two ply,

three ply, four ply. Plying increases the diameter, strength and quality of the yarn. The direction of twisting is designated as S or Z, just as in single yarns. Normally the folding twist is in the opposite direction to that of the single yarns.

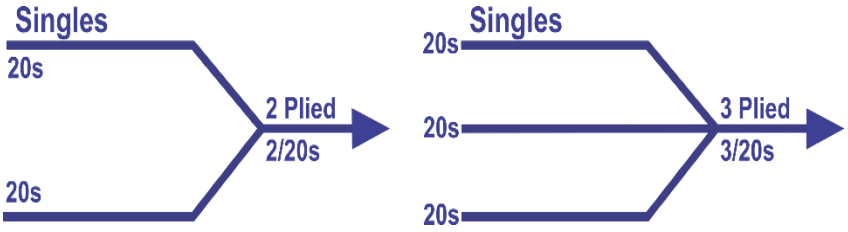


Fig. 1.9: Ply Yarn

A **cord yarn** is made by undertaking third twisting operation, where ply yarns are combined and twisted together (Fig. 1.10).

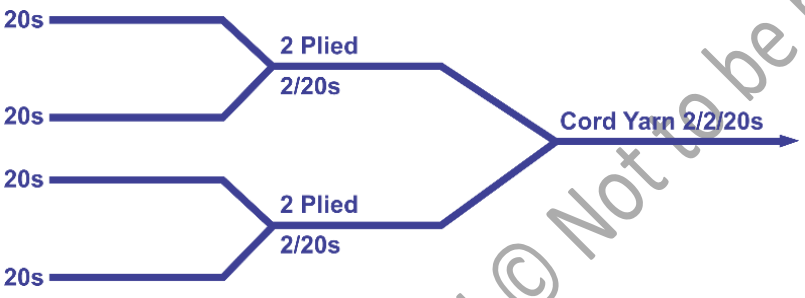


Fig. 1.10: Cord Yarn

- **Complex/ Novelty Yarn**

Novelty yarns are classified as yarns that are irregular at regular intervals. The decorative effects in these yarns can be given during the spinning process by varying the amount of twist or by twisting yarns of different diameter. Novelty yarns are composed of core, effect and binder.

Core – It provides the structure and strength to the novelty yarn.

Effect – It creates the decorative effect.

Binder – It binds the base and effect yarn if required.

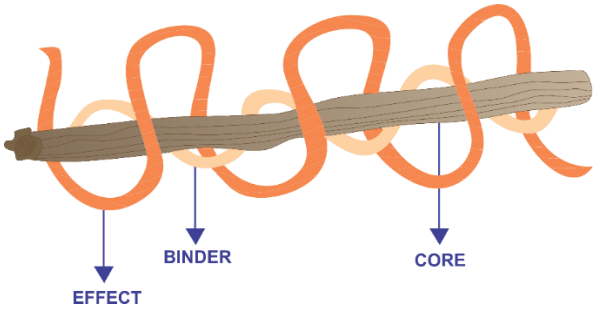
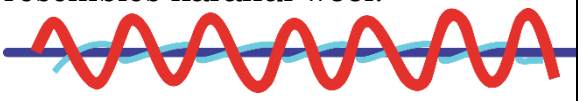


Fig. 1.11: Components of Novelty yarn

Novelty yarns can give fabrics almost limitless textural effects of various colour combinations.

Table 1.7: Complex/Novelty Yarns

S. No.	Complex/Novelty Yarns	
1.	**Slub yarns** – have soft, untwisted areas at frequent intervals throughout their length. They may be single or ply yarn varying in amount of twist at intervals. 	 http://www.msyarn.com/english/slub_yarn.htm
2.	**Spiral yarns** – are made by winding a coarse yarn over a fine yarn. 	 http://clothing120.weebly.com/blog/archives/10-2014
3.	**Nub, Knot or Spot yarn** - are made by twisting the effect ply around the core ply many times within a very short space, causing bumps or knots at intervals. 	 http://www.msyarn.com/english/knot_yarn.htm
4.	**Chenille yarn** – term chenille is French for caterpillar. The effect is achieved by a core of two yarns plied together and firmly holding short tuffs of soft-twisted yarns between the twists. The result is a yarn with a velvette like effect. 	 https://www.yarn-paradise.com/velvet-chenille-burgundy

5.	**Boucle, loop or curl yarn** - is accomplished by allowing one of the piles to remain slack during the twisting operation causing it to twist on itself and form a loop. It resembles karakul wool. 	 http://www.stitchpiecenpurl.com/boucle.htm

Novelty yarns have low strength and also have poor abrasion resistance. Fabrics manufactured from novelty yarns are generally not durable and should be avoided for manufacturing those fabrics where durability and long wear is required.

Yarn Blending

A blend is a mixture of fibers, twisted together into a yarn. This can be created by mix Blending of fibers are done for several reasons:

- To improve the fibre uniformity.
- To improve spinning, weaving, and finishing efficiency.
- To obtain better texture, hand, or fabric appearance.
- For economic reasons and cost cutting.
- To achieve cross-dyed and union dyed, different color effects.
- One of the most important reasons for blending is to produce fabrics with better performance. If durability is very important, then nylon or polyester is blended with cotton or wool to provide strength and resistance to abrasion. Polyester when blended with cotton contributes in strength, wrinkle resistance and cotton provide comfort and absorbency. If polyester added with wool, gives strength and wool gives warmth, resiliency and absorbency.

Factors Affecting Yarn Properties

Yarn properties are among the most important parameters that affect fabric surface properties.

- **Staple Length:** The strength of yarn is directly proportional staple length of the fiber used to make it. Using long staple fibers provide yarn with higher strength.
- **Fiber Fineness:** The strength of yarn is inversely proportional to the fineness of fiber used to spun the yarn. Finer the fiber used more is the strength of the yarn, similarly the coarser the fiber used spun yarn has less strength. This property is attributed to the fact that due to fineness of the yarn a greater number of strands of fiber were combined (due to less diameter of the strand) to spun the yarn as compared to coarse yarn where the number of strands decreases. These higher numbers of strands in the cross section of yarn also

increases internal friction and the resultant effect is that the yarn has higher strength.

- **Fiber Strength:** The strength of the yarn is dependent on the fiber mix used to spun the yarn. If the fiber used have more strength, then the resultant yarn will have more strength.
- **Twist:** During spinning, twist to the fiber is given so that they can hold the yarn together. Strength of the yarn is thus dependent on the twist and the nos. of twist given to the fibers. However, there is an optimal number of twists that should be given, beyond which the strength of the yarn start decreasing. This optimal number of twists should be same for fibers having same properties and characteristics.
- **Evenness:** Yarn strength is directly proportional to the evenness or the uniformity of fibers used. Evenness can be with respect to the count, number of twists, physical properties etc. More uniform the fibers more will be the strength of the yarn and vice versa.
- **General Factors:** Beside the above, there are many other variables that influence the strength of yarn. The chemical treatment given to yarn after spinning such as during the process of sizing etc. Environmental factors also play an important role in yarn strength, such as testing equipment used, the length of the yarn, the skill of the tester, water content in the yarn, weather, etc. are some of them.

Activities

Activity 1

Prepare a chart on the classification of various yarns

Materials Required:

1. Colored sheets
2. A4 size papers
3. Pen, pencils and colored pens
4. Eraser
5. Sharpener
6. Ruler
7. Different samples of yarns

Procedure:

1. Collect the required information, pictures and yarn samples.
2. Ask your teacher about info graphic and how to make it.
3. Organize the collected information in the form of an infographic.

Check Your Progress

True Or False

1) Yarn is the finished product of the spinning and winding process. (True/False)
2) Spinning is the process of making yarn from filament fibers. (True/False)
3) Filament yarns can be either monofilament or multifilament. (True/False)
4) Filament yarn has protruding ends, giving it a dull fuzzy look. (True/False)
5) Ply yarn is created by combining two or more single yarns through a second twisting operation. (True/False)

Fill in the Blanks

1. Novelty yarns are _____and symmetrical throughout.
2. Chenille yarn achieves a velvet-like effect by _____two yarns plied together.
3. Yarn blending is not done solely for economic reasons and _____.
4. Yarn properties are significant _____affecting fabric surface properties.
5. The strength of yarn is inversely _____to the staple length of the fiber used to make it.

Question Answers

1. How does spun yarn differ from filament yarn?
2. List and describe the different types of simple yarns.
3. What are different components of novelty yarn?
4. Why blended yarns produced?
5. List the factors that effects the yarn properties.

Session 3:	Define And Describe Fabric Properties, And Factors Affecting Fabric Properties

FABRIC

Fabric can be seen as a compact arrangement of fibers and yarn (Fig 1.12). The fabric can be subdivided into woven, knitted and non-woven (Fig 1.13). This grouping is based on the methods they are produced.

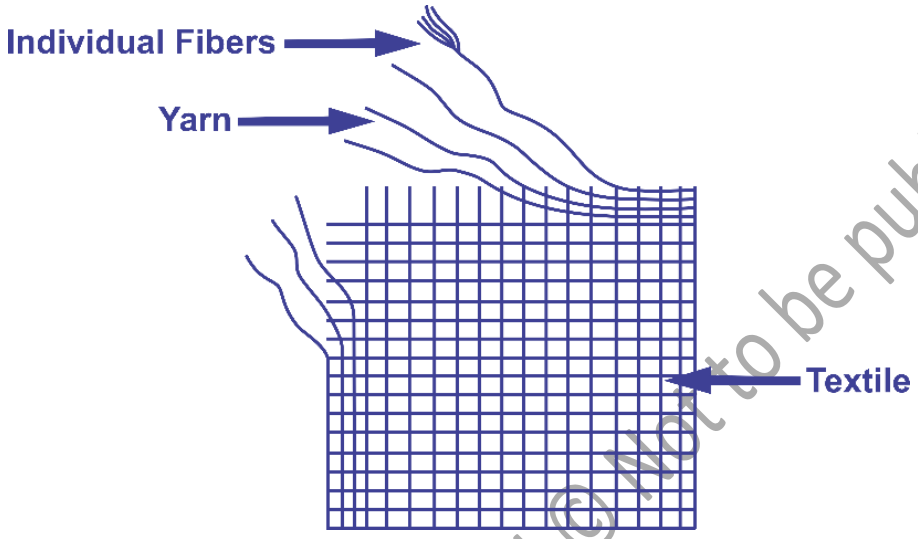


Fig. 1.12: Fabric

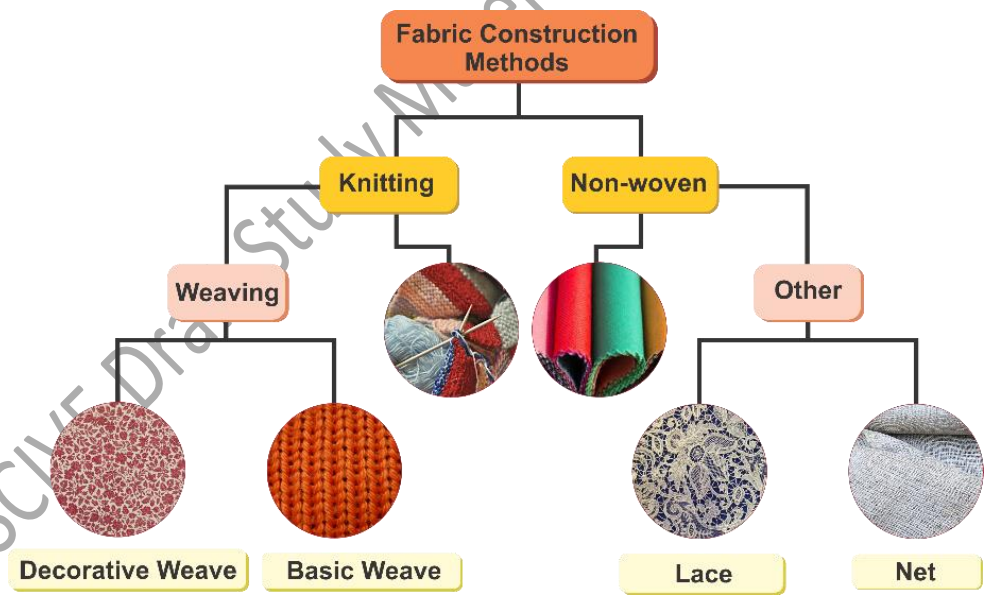


Fig. 1.13: Methods of Fabric Construction

Weaving

In weaving, fabric is produced by interlacing two sets of yarns at right angles to each other (Fig 1.14). The weaving of a fabric is done by interlacement of yarn on a loom. Loom is a device used for construction of fabric by the process called weaving. Fabric made by weaving is called woven fabric.

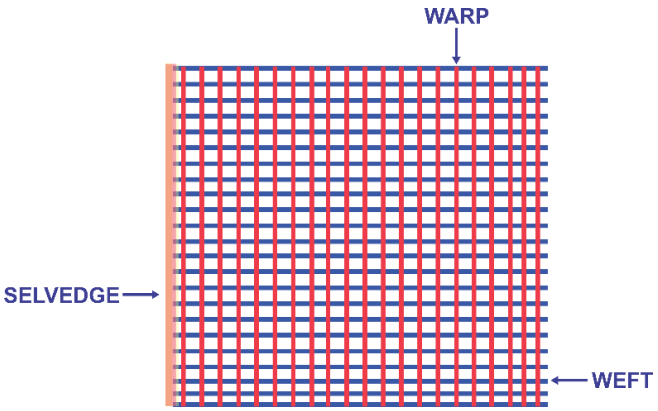


Fig. 1.14: Terms used on Fabric

Weaving Terminology

Warp:These are also called as ends or *TANA*. These yarns run in length wise direction of the fabrics and are parallel to the selvedge.

Weft: These are also called as picks/fillings or *BANA*. They are perpendicular to the warp yarns.

Selvedge: These are the edges that run parallel to warp yarns. It gives strength to the edges of the fabric, and helps to retain the shape.

Thread Count: It is referred as the total number of warp and weft yarns per square inch of a woven fabric. Fabrics with higher thread count are denser and thus have higher durability than those with lower thread count.

EPI: Ends per inch is the number of warp threads per inch of woven fabric.

PPI: Picks per inch is the number of weft threads per inch of woven fabric.

Types of Weaves

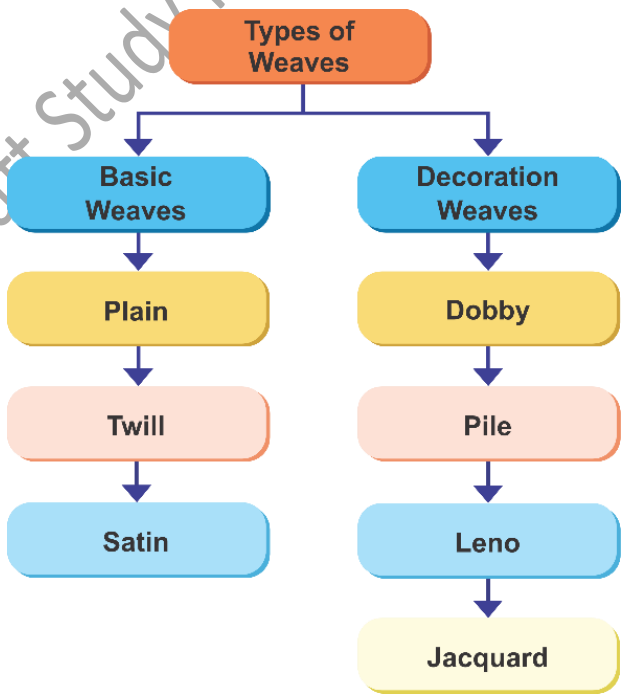


Fig. 1.15: Types of Weaves

Table 1.8: Basic Weaves

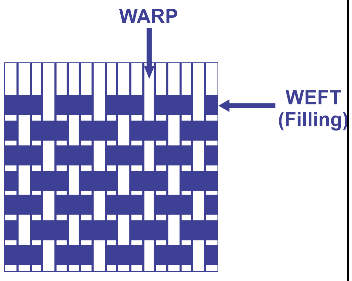
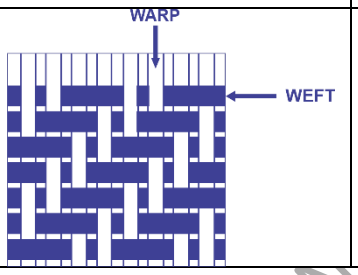
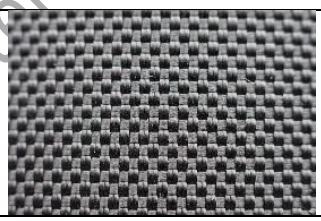
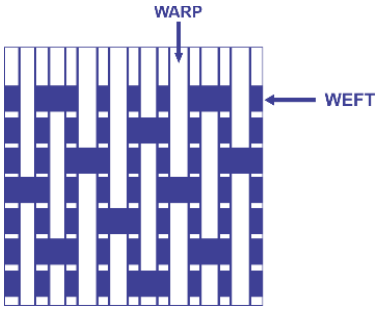
Basic Weaves	Characteristics	Weave image	Types	Fabric
PLAIN WEAVE	• It is the simplest and inexpensive weave. • Weft yarn goes alternately under and over the warp yarns • Closer the yarns higher will be the thread count	- 	• Rib Weave • Basket Weave	Dupatta, saree
TWILL WEAVE	• It has a clear diagonal line on the front side of the fabric. • It is a very strong weave		• Herringbone • Diamond • Right hand • Left hand • Pointed	Denim-jeans fabric, gabardine-suits and coat fabric.

Table 1.9: Decorative Weaves

Decorative Weaves	Characteristics	Images	Fabrics
Dobby	• Contain simple geometric designs. • More textured than plain weave.		Dresses, shirts, handbags
Pile	• Produce fabrics with raised surface. • Extra sets of warps or filling yarns are woven over ground fabric to form loops. • loops may be left uncut, or they may be cut to expose yarn ends		Velvets, towels, corduroy, carpets
Leno	• Also known as Gauze weave • two warp yarns are twisted around the weft yarns • provide a strong yet sheer fabric		Dresses

Jacquard	• Used to create complicated designs • detailed images of objects such as flowers and birds can be made		Brocade for dress, saree, curtains.
Satin Weave	• It has a beautiful shiny surface • Warp yarns are more visible than fillings on the right side of the fabric. • These visible yarns are called floats • It is not as strong as plain or twill weave.		Sateen weave Chenille fabric, shantoon

Knitting

The technique of producing textile fabrics interloping of yarn loop with loops of same or different yarns is called **knitting**. Various different garments can be made by this process such as men vests, socks, etc. (Fig 1.18). In construction of knitted fabric, loops are formed. New loops are drawn through previously formed loops (Fig 1.17).

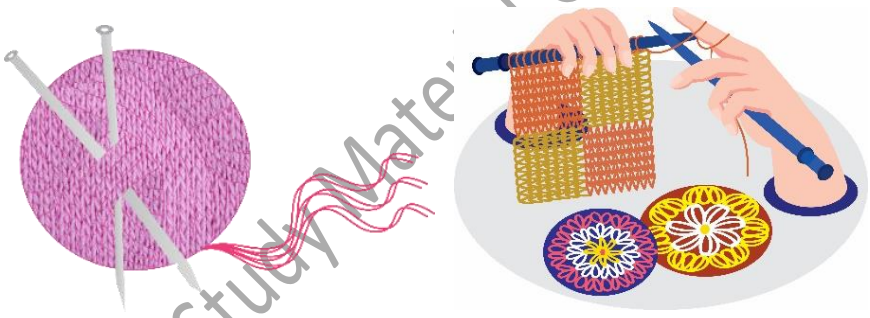


Fig. 1.16: Knitting

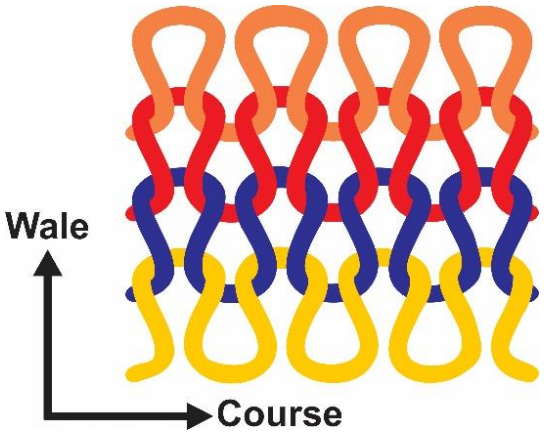


Fig. 1.17: Loop Formation

Knitting Terminology

Course: The series of loops those are connected horizontally are called as course.
Wales: The series of loops that connected vertically are known as Wales.
Knit fabrics are mainly used for hosiery products such as t-shirts, socks etc. (Fig 18).

(a) (b)

Fig. 1.18: (a) Knitted t-shirt (b) Knitted socks

Difference between weaving and knitting

S. No.	Weaving	Knitting
1	Fabric is produced by interlacing minimum two sets of yarns	Fabric is produced by interloping minimum one yarn.
2	Requires a loom	Requires knitting needles or a machine
3	Horizontal and vertical yarns are called weft and warp	Horizontal and verticals loops are called courses and wales
4	Example: dupatta, saree	Example: T-shirt, socks

Non Wovens

Fabrics that are produced directly from fibers without making yarn are called as non-woven. Thus, process of weaving or knitting is also absent. Fibers are held together by mechanical forces, resin or heat. The raw materials for non-woven fabrics are fibers (staple and filament) (Fig 1.19).

(a) (b) (c)

Fig. 1.19: (a) Non-woven fabric (b) Non-woven bags (c) Non-woven mask

Effect of Fabric Construction on Fabric Properties

Fabric construction is the most decisive aspect which have a crucial influence on the nature of the fabric such as drape, durability, softness, sturdiness and opacity. Looking around you and clothes you wear, you will realize that some fabrics are thin and some are thick, some fabrics are opaque and some are transparent, some are stiff and some are limp, etc. Strength of the woven fabric is an important property of fabric and is measured as tensile, bursting or tearing strength. Beside other factors that have a bearing on the fabric strength, thread count plays a crucial role in it. Fabric having high thread count will have more tearing strength then those having low thread count. Similarly, when the number the interlacement points in the fabric increases then after processing the fabric will have lower shrinkage but the tensile strength is more.

Factors Influencing the Choice of Fabric

Choosing the right fabric for a particular application involves considering several factors to ensure that the fabric meets the intended purpose and requirements. Here are some of the key factors that affect fabric choice:

End Use and Application: The most crucial factor is the intended use of the fabric. Whether it's for clothing, upholstery, bedding, or industrial purposes, the fabric must be appropriate for the specific application.

Durability: Depending on how often the fabric will be used and the conditions it will encounter, durability becomes important. Fabrics used for heavy-duty applications need to be more robust and resistant to wear and tear.

Strength and Tenacity: The strength of the fabric is vital, especially for applications where it will be subjected to significant stress or weight.

Comfort and Feel: For clothing and home textiles, the comfort and feel of the fabric against the skin or to touch are important considerations.

Weight: The weight of the fabric affects its drape, warmth, and suitability for different seasons or climates.

Breathability and Moisture Wicking: In some applications, such as sportswear or bedding, fabrics that allow air circulation and wick away moisture are preferred.

Ease of Care and Maintenance: Fabrics that are easy to clean, wash, and maintain can be more practical for certain applications.

Allergies and Sensitivities: Some individuals may have allergies or sensitivities to certain fabrics or chemicals used in fabric manufacturing.

Color and Appearance: The color and appearance of the fabric are crucial for aesthetic reasons and how well it matches the overall design or theme.

Cost and Availability: The cost of the fabric and its availability in the required quantity can influence the final choice.

Environmental Impact: Increasingly, the environmental impact of fabrics is a significant consideration, with a growing demand for sustainable and eco-friendly options.

Regulatory Compliance: Some applications, like children's clothing or medical textiles, may need to meet specific safety and regulatory standards established by authoritative organizations.

Fire Resistance: For applications where fire safety is critical, fabrics with fire-resistant properties may be necessary.
Special Features: Some fabrics may have unique properties like water resistance, UV protection, antimicrobial properties, etc., which can be advantageous for specific applications.

Thus, considering these factors will help in selecting the most suitable fabric for the intended use, ensuring it performs well and meets the necessary requirements.

Uses of different Fabrics- Medicinal, Sports, Apparel, Industrial:

Depending on their usage or functionality, textiles can be grouped into two main areas namely

- Consumer textiles for domestic purpose, in this group comfort and aesthetic is an important factor. Clothing, bags, carpets, apparel, accessories like hats, scarves, curtains are some of the items that are part of this group.
- Technical textiles for special usage, here functional properties are an important criterion. Geotextiles, industrial textiles and medical textiles are some of the usages of this group of textiles in our life.

Technical textiles

- Technical textiles encompass textile materials and products distinguished by their predominant utility in terms of technical performance and functional properties rather than aesthetic or decorative characteristics. This sector stands out as one of the rapidly advancing segments within the broader textile industry, dedicated to the production of high-tech, high-performance fabrics. Unlike conventional textiles primarily designed for visual appeal, technical textiles prioritize delivering substantial added value through enhanced functionality.
- The pivotal role of the textile coating process is evident in the manufacturing of technical textiles, playing a crucial part in imparting specific performance attributes to these fabrics. While the textile industry traditionally centered around clothing applications, the contemporary landscape underscores a significant shift towards non-clothing applications, commonly referred to as technical textiles.
- What sets technical textiles apart is their distinctive nature and the challenge they present. Addressing technological and engineering problems requires a profound understanding and application of textile science and technology principles. This strategic approach not only tackles leading technological issues but also extends to the realm of engineering problem-solving within the domain of technical textiles.

Classification of Technical Textiles

Technical textiles can be broadly classified into several categories based on their intended functional applications. Here is a brief overview of the main classifications:

- **Agro Textiles**: Used in agriculture for activities like crop protection, weed control, and soil erosion prevention.
- **Meditech Textiles**: Designed for medical and healthcare applications, including surgical gowns, bandages, and implants.
- **Buildtech Textiles**: Applied in construction for purposes such as reinforcement, insulation, and protection against environmental elements.
- **Hometech Textiles:** Used in household applications, including furnishings, carpets, and cleaning materials.
- **Geotech Textiles:** Employed in geotechnical engineering for applications like soil stabilization, erosion control, and drainage.
- **Oekotech Textiles:** Environmentally friendly textiles that address ecological concerns, such as recycling and sustainable practices.
- **Packtech Textiles:** Applied in packaging materials to provide strength, durability, and protection for various goods.
- **Protech Textiles:** Designed for protective clothing and equipment, such as bulletproof vests, fire-resistant clothing, and industrial safety gear.
- **Sportech Textiles:** Tailored for sports and recreational activities, including sportswear, equipment, and accessories.
- **Indutech Textiles:** Used in industrial applications, such as filtration, conveyor belts, and insulation.

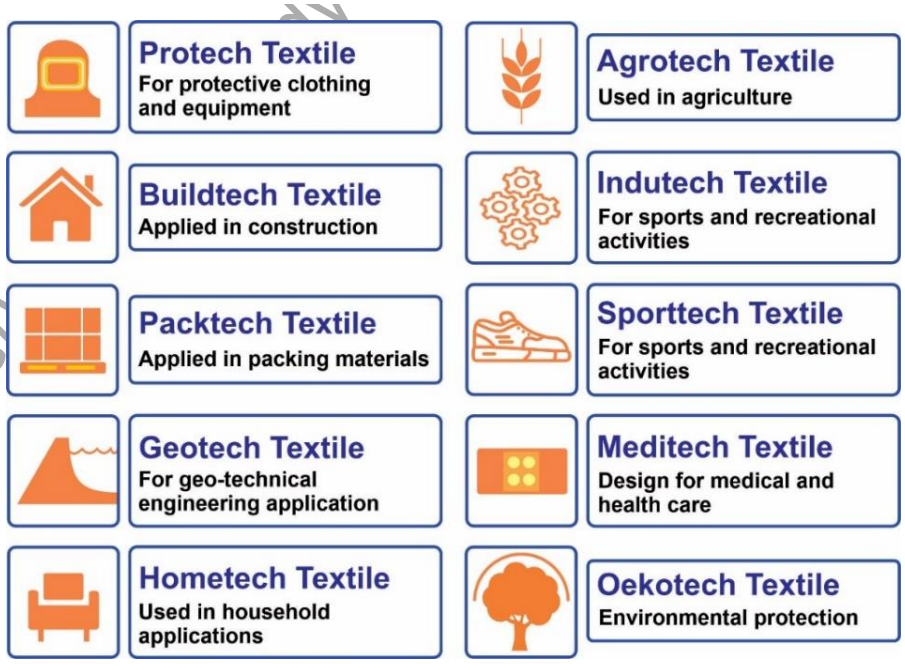


Fig. 1.20: Classification of Technical Textiles

Application of Jute in technical textiles

Jute, a versatile natural fiber from the Corchorus plant, is more than just a textile and packaging material. It's eco-friendly – breaking down in landfills without harmful byproducts. In textiles, jute products are both reusable and disposable.
As a renewable resource, jute helps save energy. Its strong fibers are resilient, and the products are not just good-looking but also eco-conscious. Jute's high strength, low elongation, and great water absorption create vibrant colors. Plus, it handles heat well and has a unique surface – making it both attractive and practical.

- **Geotech Textiles:** Jute's natural biodegradability finds practical application in Geotech Textiles. The fiber is employed for soil erosion control, slope stabilization, and embankment reinforcement, providing eco-friendly solutions to address environmental challenges.
- **Agro Textiles:** In the realm of Agro Textiles, jute plays a vital role in crop protection, weed control, and soil improvement. Its breathable and moisture-absorbing properties make it an ideal choice for fostering optimal conditions for plant growth.
- **Buildtech Textiles:** Jute has made inroads into Buildtech Textiles, particularly in the creation of composite materials for construction. Jute-reinforced composites offer a balance of strength and eco-friendliness, suitable for applications such as wall panels, roofing materials, and insulation.
- **Meditech Textiles:** Jute's anti-bacterial and hypoallergenic qualities make it relevant in certain Meditech Textiles applications. Its potential use includes medical textiles like wound dressings and bandages, contributing to sustainable and biodegradable solutions in the healthcare sector.

In conclusion, the application of jute in technical textiles goes beyond its traditional uses, showcasing adaptability and sustainability. As industries seek eco-friendly alternatives, jute emerges as a promising candidate, influencing the evolution of technical textiles.

Activities

Create Samples of Different Weaves Using Paper Strips, Wool Yarns, or Satin Ribbons

Materials Required:

1. Paper strips (various colors and sizes)
2. Wool yarns (different colors and textures)
3. Satin ribbons (various colors and widths)
4. Scissors
5. Glue or tape
6. Ruler

7. Pencil
8. Cardboard or fabric swatches for backing

Procedure:

1. **Gather Materials:** Collect all the materials listed. Ensure you have a variety of paper strips, wool yarns, and satin ribbons in different colors and textures.
2. **Introduction to Weaves:** Briefly review different types of weaves with your teacher or refer to class materials. Focus on basic weaves such as plain weave, twill weave, and basket weave.
3. **Prepare Templates:** On a piece of cardboard or fabric swatch, draw a grid or basic template that will serve as the base for your weave samples.
4. **Create Weave Samples.**
5. **Review and Adjust:** Examine each sample to ensure the weave is correctly represented and the materials are securely attached. Make any necessary adjustments.
6. **Label and Present:** Label each sample with the name of the weave (Plain, Twill, Basket) and a brief description of the pattern. Present your samples to the class or in a group setting.

Feedback: After presenting, gather feedback from your peers or teacher on your samples. Discuss the challenges you faced and what you learned from the activity.

Check Your Progress

True Or False

1. Fabric can be classified into two groups: woven, knitted, and non-woven. (True/False)
2. Warp yarns run parallel to the selvedge in weaving. (True/False)
3. Weft yarns are perpendicular to the warp yarns in weaving. (True/False)
4. Thread count refers to the total number of weft yarns per square inch of a woven fabric. (True/False)
5. Twill weave has a clear diagonal line on the backside of the fabric. (True/False)

Fill in the Blanks

1. Knit fabrics are mainly used for _____products such as T-shirts and socks.
2. Non-woven fabrics are produced directly from fibers without making_____.
3. Factors influencing the choice of fabric include end use, _____, and tenacity.
4. Weaving produces fabric by interlacing _____ sets of yarns at right angles to each other.

5. The edges of the fabric that run parallel to warp yarns are called _____.

Question Answers

1. What is selvedge?
2. List some of the simple and decorative weaves.
3. How knitting differs from weaving?
4. What are some of the important uses of fabric?
5. What are technical textiles?

Module 2: Introduction to Jute

Module Overview

In this Unit, we embark on an exciting exploration of a remarkable material known as jute. Often referred to as the "golden fiber," jute is a natural bast fiber that comes from the Corchorus plant species. This plant plays a vital role in various industries, serving as the foundation for a wide range of products, from bags and sacks to mats, tarpaulins, and decorative items. Jute is not only commercially valuable but also environmentally important due to its ease of spinning and biodegradable nature.

This unit offers a comprehensive introduction to the world of jute fiber. Our journey begins by delving into the fundamental properties that make jute unique, both in terms of its physical and chemical characteristics. From its strength and dimensional stability to its compatibility with a variety of chemical agents, jute proves to be a versatile material suitable for a wide range of applications.

We also take a detailed look at the journey of jute fiber from its botanical source to its final form. We explore the intricate cultivation process, focusing on the necessary climate conditions, soil requirements, and the various stages that include retting, stripping, washing, and drying. These complex steps result in the extraction of high-quality fibers, ready for further processing.

Furthermore, we delve into the world of jute yarn production, unravelling the intricacies of the spinning process. This transformation involves several stages, including carding, drawing, roving, and spinning, which collectively convert jute fibers into strong, functional yarns, ready to be woven into a variety of textiles.

Our exploration of jute fiber covers aspects such as its classifications, structural characteristics, cultivation techniques, inherent properties, processing methods, and eventual production. Through this in-depth understanding of jute, we aim to highlight its importance and adaptability across industries, setting the stage for a deeper exploration in further sessions.

Learning Outcomes
After completing this module, you will be able to: • Identify and describe jute fiber, and Yarn • Explain production and finishing process of jute fabric • Describe Jute Recycling
Module Structure
Session 1: Introduction to jute fibre
Session 2: Explain production and finishing process of jute fabric
Session 3: Introduction to jute recycling

Session 1: Identify and Describe Jute Fiber and Yarn

Jute is a natural cellulosic fibre, categorized as a plant based bast fibre. Bast fibres are collected from the bast or skin of the plant. Due to its natural golden sheen, it is commonly known as the Golden fibre. It is a major commercial and second most widely used fibre. Jute is easily spun and economical fibre and is considered as one of the most economical and eco-friendly natural fibres in the world.

Jute fiber has 100% biodegradability and recyclability, making it an economical and eco-friendly choice. It ranks as the second most significant plant-based fiber, after cotton, in terms of usage, global consumption, production, and availability. With properties such as high tensile strength, low extensibility, and the ability to enhance fabric breathability, jute proves to be an excellent choice for bulk packaging in agricultural commodities. It is used in the production of industrial yarn, fabric, nets, and sacks, showcasing its versatility as a natural fiber used across various sectors including packaging, textiles, non-textile industries, construction, and agriculture. Jute is primarily grown in the eastern part of India. The main jute-producing states in India include West Bengal, Bihar, Assam, and Odisha. West Bengal, especially the Hooghly basin, is one of the largest jute-producing regions in the country. The primary producers of the jute trade are India and Bangladesh, with South Asia being the central hub for this industry. Jute, an annually renewable plant, is classified under the Corchorus genus of the Tiliacea order, and is typically grown in two main species: Corchorus olitorious, known as Tossa jute, and Corchorus capsularis, commonly referred to as White jute. These two species are produced on a significant scale for commercial purposes.

Jute fiber's biodegradability, renewability, and versatility make it a sustainable choice for various applications across different industries. Jute fibre's primary use is in fabrics for packaging a wide range of agricultural and industrial commodities that require bags, sacks, packs, wrappings, carpet backing, mats, tarpaulins, ropes and twines. Besides, jute yarn is used to produce various types of decorative jute goods. Burlap fabric is made from jute. Jute fibre blended with cotton fibre is also used as an apparel fabric but has not gained popularity due to the rough texture.

Fig. 2.1: Jute Fiber

Types of Jute

There are four different types of Jute fibres. It comes from either of the two species of Corchorus plant- C. capsularis, or white jute, and C. olitorius, or Tossa jute.

- White Jute: This is the most ancient type of jute. Corchorus capsularis is commonly known as white jute. The colour of this variety is brighter than the others. However, this type is less durable than many others.
- Dark Jute or Tossa Jute: Tossa is the most popular type of jute in recent times. It is in golden brown shade. Tossa jute has long fibres and is used for making gunny sacks and bags. Tosa jute fibre is soft, silky, and stronger than white jute.
- Mesta Jute: This type of fiber is a combination of white jute and Tossa jute. Mesta jute emerged in India in late 1940s.
- Jute Cuttings: These are the leftover jute which look like waste, but they can be very useful for making rudimental textiles. These are not strong and have a rough texture. Jute cuttings are used to make bags, ropes, paper products and basic textile materials.

(a) Corchorus capsularis (White Jute)

(b) Tossa Jute (Dark Jute)

(c) Mesta Jute

Fig. 2.2 (a , b & c) : Types of Jute

The primary components found in jute fiber include cellulose (comprising 60-72% of the composition), hemicellulose (making up 12-24%), lignin (constituting 11-24%), along with minor amounts of pectin (0.2%), ash (ranging from 0.5 to 2%), wax (0.5%), and fats. Cellulose plays a key role in providing stiffness to jute fibers. Presence of hemicellulose in jute fibres makes it hygroscopic. Hygroscopic fibers have a strong affinity for moisture and can absorb and retain water molecules,

making them useful in various applications where moisture management is important.

Structure of Jute Fibre: Unlike cotton which is unicellular, jute fiber is a multicellular fiber composed of cylindrical sheaths formed by ultimate cells joined in a three-dimensional network along the length of the stem. Jute is composed of spindle-shaped ultimate cells with an average length of 2.5 mm and width of 0.02 mm. These cells possess thick cell walls and lumens, aiding structural integrity and fluid movement. The fiber's structure includes a middle lamella, acting as natural cement between ultimate cells, reinforcing its strength and cohesion. This intricate arrangement shapes jute's properties, making it versatile for various applications in industries due to its unique mechanical attributes.

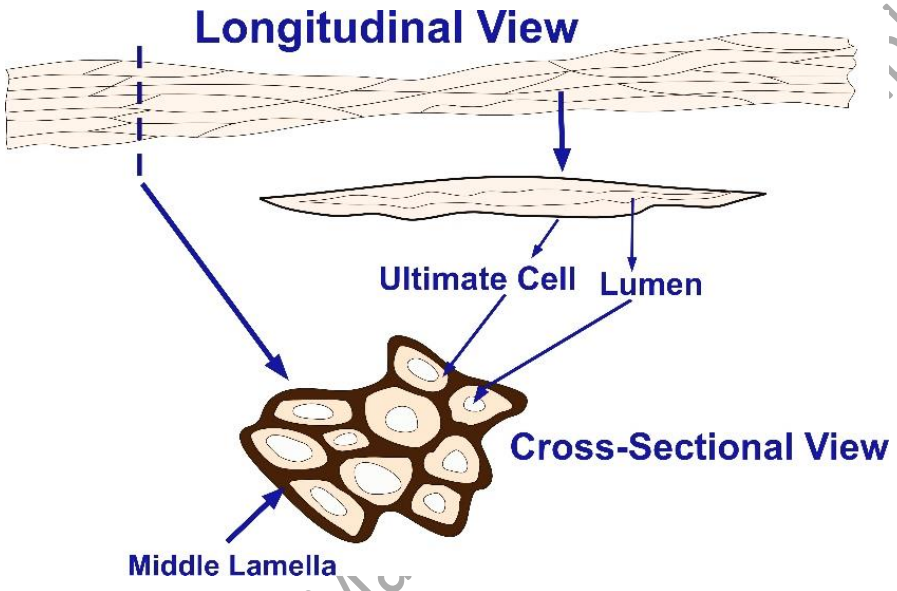


Fig. 2.3: Types of Jute

- **Identification of Jute fibre:** Non-technical Test:
- **Visual appearance**: Jute fibers are typically golden brown to light brown in color. They have a slightly shiny appearance and a coarse texture. The fibers are long and soft.
- **Feel and texture**: Jute fibers have a natural, slightly rough texture.
- **Burning Test**: When jute fibers are burned, they have a strong smell that resembles burning wood or leaves. The ash left behind after burning is generally gray or white and has a powdery texture.

Fiber identification often requires a combination of non-technical and technical tests. While technical methods of fiber identification require technical equipment, there are non-technical tests that can help to identify fibers to some extent.
Technical Test:

- **Microscope test**- The longitudinal section of Jute fibre appears smooth with nodes or cross-markings appearing occasionally. The cross section appears polygonal with rounded corners.

- **Solubility**: Jute dissolves in 70% sulphuric acid.

Properties of Jute fibres (Physical and Chemical)

Physical Properties:

- **Length:** The length of Jute fiber reeds ranges from 3 to 14 feet, depending on their grade, and they exhibit a gradual taper from the root to the tip. Thicker reeds contain coarser fibers, while thinner reeds contain finer fibers. These reeds are composed of individual fibers with an average length of approximately 2.5mm.
- **Fineness:** Jute is considered a coarse fiber, with a diameter spanning from 6 to 20 microns.
- **Strength:** Compared to some other bast fibers, Jute fibers are not exceptionally strong, but they possess good tensile strength.
- **Abrasion Resistance:** They are naturally rigid and brittle, making them susceptible to breaking upon abrasion. Their resistance to mechanical wear is relatively low, especially when exposed to moisture, which further diminishes their strength. They exhibit an extension at break of 2%.
- **Colour:** The highest quality Jute fibers are characterized by a pale white or silvery grey color, while common grades tend to have a brownish or greenish tint, which indicates lower quality. Additionally, the roots of Jute fibers typically exhibit a darker shade and lack any noticeable luster. Superior quality fibers display a matte and pitted surface texture, which is indicative of their relatively low strength.
- **Luster:** Higher-quality Jute fibers possess a relatively high luster, whereas inferior-quality fibers exhibit a matte and pitted surface texture, which is accompanied by significantly reduced strength.
- **Absorbancy:** Jute is a hygroscopic fiber, meaning it can absorb or release moisture depending on its surroundings. When its fibres become wet, they can expand by as much as 23% in diameter. The moisture regain of jute ranges from 11% to 13%, which is somewhat greater than cotton's moisture regain of 7% to 8%.

Chemical Properties:

- Effect of Acid: Jute fibers are susceptible to damage when exposed to strong acids, making acid-based wet processing unsuitable for them.
- Effect of Alkali: Jute fibers are resistant to damage in an alkaline environment, allowing for wet treatments using alkali solutions. Woolenization is a transformative process for jute fibers, enhancing their appearance and texture. It involves treating jute fibers with a strong alkali, leading to significant alterations in their physical structure. This treatment causes the fibers to swell laterally and shrink in length, resulting in a soft, crimped, and wavy texture, reminiscent of wool. The resulting modified jute fibers exhibit irregular crimps,

a "wool-like" appearance and improved characteristics, a phenomenon referred to as "woolenization" of jute.

- Effects of Biological Agents and Light: Jute fibers are vulnerable to degradation caused by microorganisms such as bacteria, fungi, moths, and insects, particularly in humid conditions. Exposure to sunlight can also result in the yellowing of the fibers.

- Effect of bleaches: Bleaching agents like sodium chlorite and hypochlorite are employed to remove color from jute fibers by dissolving lignin. Although this process results in a whiter appearance for the jute, it also weakens and refines it to some extent due to the partial breakdown of its multicellular structure.

Cultivation and Processing of Jute Fibres Cultivation of Jute Fibre

The jute plant typically grows to a height of 1.5 to 4.5 meters with a stem diameter of up to 20mm. It is usually sown between March and May, depending on rainfall and land type. The best soil for jute cultivation is deep and enriched with salts from annual floods, a loamy alluvial soil. The optimal pH range for jute cultivation falls between 6 and 7.5. Jute thrives in warm and humid conditions, with a temperature range of 25-40 degrees Celsius and humidity levels between 70% to 90%. Adequate rainfall is also necessary for successful cultivation.

Fig. 2.4: Jute Cultivation in India

The two species grown for jute fiber are quite similar, differing mainly in their seed pod shape, growth patterns, and fiber qualities. They thrive in well-drained sandy loam soil and need warm, humid climates with a monthly rainfall of 3 to 4 inches during the growing season. These plants have light green leaves measuring 4 to 6 inches in length and about 2 inches in width with serrated edges that taper to a point. Additionally, they produce small yellow flowers.

Fibres in the jute plant are located beneath the bark and encircle the central woody part of the stem. These fiber strands typically extend the entire length of the stem. Jute is typically harvested after the flowers have fallen but before the seedpods fully mature. Harvesting too early results in weak fibers, while waiting until the seeds are ripe produces stronger but coarser fibers without the usual shine.

Processing of Jute fibres

The jute plant's fibres lie beneath the bark and surround the woody central part of the stem. The fibre strands nearest the bark generally run the full length of the stem. A jute crop is usually harvested when the flowers have been shed but before the plants' seedpods are fully mature. If jute is cut before then, the fibre is weak; if left until the seed is ripe, the fibre is strong but is coarser and lacks the characteristic lustre.

Stages of Production and Processing:

Harvesting

After 120-150 days the jute plant is harvested when the flowers have been shed. Observations have proved that early harvesting gives good fibres. The harvested plants are kept in the field for 3 days so that the leaves are shed.

Retting:

Retting is a biological process that involves the removal of pectin, which binds jute fibers. It occurs when bundles of jute fibers are soaked in water (at a depth of 60-90cm) for 10-30 days. During this period, bacteria decompose the hard cell walls and break down the gummy tissues surrounding the fibers, resulting in the loosening of the jute fibers.

Fig. 2.5: Retting of Jute

Stripping:

Stripping is the fiber extraction process, which involves separating fibers from plant stalks after retting. This is done by beating the root ends with a paddle to loosen them and then breaking off the stems near the root. The fiber strands are then removed from the stem using one of two methods: either by individually extracting fibers from single plants or by using a to and fro motion in water to break a handful of stalks and removing the fibers.

Washing:

The fibres are then washed, dried, sorted, graded, and baled in preparation for shipment to jute mills. Once the fibres are extracted the fibres are washed in clean water. The dark colour of fibres can be removed by dipping them in a tamarind water for 15 to 20 min and again washed in a clean water.

Drying:

The fibres are hung on bamboo railings to sun dry for about 2 to 3 days. After drying, the fibres are ready to be packed.

Fig. 2.6: Drying of Jute Fibres

Bailing, Packing & Storage:

After drying the jute fibers, they are sorted and bailed based on a grading system, which includes categories like top, middle, and bottom quality. These fibers are then packed into Kutcha bales, each weighing approximately 250 pounds, intended for use in mills or the jute market. These bales are subsequently stored for future distribution or processing. Raw jute is transported to jute mills from fields or suppliers via trucks and stored in the mills' godown. The production of jute yarn from jute fibres goes through several processing steps.

Fig. 2.7: Bailing, Packaging & Storing

Production of Jute Yarns

Selection: In the selection process for raw jute, experienced workers open the bales to identify and remove any defects. These bales come in two types, weighing either 150 kg or 180 kg and may or may not have the top portion cut. The selection process

categorizes the bales based on their intended use, such as Hessian weft, Sacking wrap, or Sacking weft. After selection, the jute bales are then transported to the softening section.

Softening: The softening process for jute involves making it soft and flexible. There are two main methods for achieving this: using a softening machine or a jute goods spreader. Typically, an emulsion plant equipped with a jute softener machine is employed to lubricate and soften the tough and gummy raw jute fibers. This emulsion plant comprises components like a gear pump, motor, vat, jet sprayer, nozzles, emulsion tank, and a jacket. The outcome of this softening process is that the jute becomes pliable and suitable for carding.

Piling and Pile Breaking: Pile breaking is a crucial step in jute processing, where pile breakers break down jute piles for carding machines. Softener machines prepare material for piling, allowing superficial moisture to soften the jute. After 24 hours of piling, the material is taken to carding machines. Root cutting near the carding machine is common, accounting for 5-7% of the jute's total weight.

Carding: Carding is a crucial operation in the processing of jute fibers, involving the splitting of jute reeds and the removal of impurities. The result is the formation of a ribbon-like material called "sliver."

Fig. 2.8: Carding Process

Drawing: Drawing is a textile manufacturing process that involves reducing the width and thickness of sliver (fibrous material) by blending and doubling multiple slivers together. There are three types of Drawing Frame machines used, with varying numbers of drawing passages depending on the type of fabric being produced.

First Drawing: Slivers from the finisher carding machine are fed into the first drawing frame machine, where four slivers are combined. The first drawing frame machine blends, equalizes, and doubles the slivers, ensuring uniform quality and color. Components of this machine include delivery roller, pressing roller, retaining roller, faller screw sliders, check spring, back spring, and crimpling box.

Second Drawing: The second drawing frame machine receives the sliver from the first drawing machine and combines six slivers per head. Its purpose is to create an even more uniform sliver and reduce the jute fibers to a suitable size for the third drawing.

Third Drawing: In the third drawing, the machine uses the sliver from the second drawing, and it operates at high speed. The third drawing frame machine further crimps the sliver, making it suitable for the spinning process.

Drawing process plays a crucial role in preparing sliver for spinning by ensuring consistent quality and characteristics in the fibers. The number of drawing passages and the machines used may vary depending on the specific textile production requirements, such as for Hessian or Sacking materials.

Spinning: Spinning is the essential step in yarn production, where sliver from the third drawing is transformed into functional yarn. This process involves elongating the slivers and twisting the fibers to create strong yarns. This twist interlocks the fibres, imparting strength and structure to the yarn, which are then wound onto bobbins.

Fig. 2.9: Final winding of Jute yarn

A typical flow chart of jute spinning process includes the steps shown in Figure.

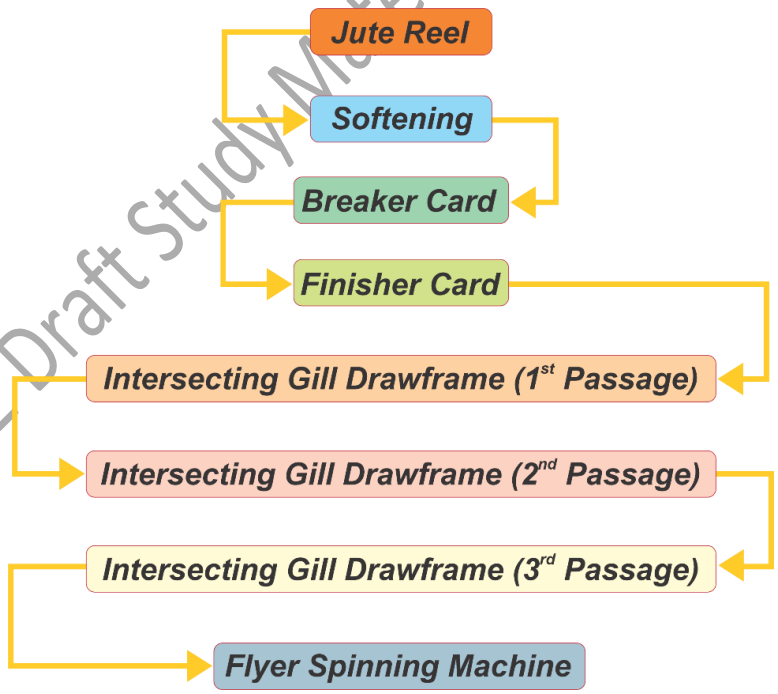


Fig. 2.10: Steps in the Production of Jute Yarns

In conclusion, the production of jute yarns is a captivating process that involves meticulous stages, each contributing to the refinement and transformation of fibres

into functional and durable yarns. From preparing the jute fibers to making threads and then twisting them into yarn, this process shows how different methods come together to create strong and flexible jute threads. These threads represent the skill and new ideas in the world of textiles. It is important for artisans and designers to understand not only the properties but also the construction of jute yarn as this will affect the quality of handicraft or handloom items prepared by them.

Activities

To identify jute fabric using technical & non-technical tests.
Materials Required- Note pad, pen, Match box, H_2SO_4, Test tubes, test tube holder, jute fabric/fibres, Microscope, glass slides
Instructions-

Kindly note the observations in the following format.

Non-Technical - Burning Test				
Approaching Flame	In Flame	Removed from Flame	Smell	Residue
Technical Test- Microscopic Test				
Longitudinal View (Diagram)		Cross sectional View (Diagram)		
Solubility Test				
Jute dissolves in 58% H_2SO_4		**Yes**		**No**

Check your progress:

True Or False

a) Jute is mainly grown in China. (True/False)
b) Jute fibre is a multicellular fibre. (True/False)
c) When burnt, jute smells like burning hair. (True/False)
d) Jute is majorly used in packaging industry. (True/False)
e) Jute fabric is soft to touch. (True/False)

Check Your Progress

Fill in the Blanks

a) The average height of jute plant is _____ meter.
b) Jute dissolves in _____ sulphuric acid.

c) Corchorus capsularis is commonly known as_____.

d) _____ is an inferior quality jute.

Question Answers

1. Discuss Jute and types of Jute.
2. Explain properties & characteristics of jute fibres and yarns.
3. Describe Jute spinning process.

Session 2: Explain Production and Finishing Process of Jute Fabric

Jute Fabric

Jute fabric is a versatile and sustainable textile material whose history dates back to ancient times, where it was used for making ropes, twine, gunny begs, sacks and other utilitarian products. However, its significance has evolved over time, and today, it is recognised for its eco-friendliness and a wide range of applications. Jute is widely used because it is inexpensive, stronger and produced in a large quantity.

One of the most striking characteristics of jute fabric is its biodegradability and sustainability. Jute plants are incredibly resilient, requiring minimal chemical inputs and thriving in tropical climates. The fibers are extracted from the plant's stem, undergo a retting process to separate the fibers, and are then spun into threads for weaving.

Jute fabric possesses a coarse texture and a natural, earthy color that adds rustic charm to various products. It is commonly used in the production of sacks, bags, and carpets due to its durability and strength. Additionally, jute's breathability and moisture-absorbing properties make it a popular choice for clothing and home textiles. Its natural insulating properties also make it suitable for eco-friendly construction materials.

In an era marked by environmental consciousness, jute fabric stands as a symbol of sustainability and responsible production, offering a viable alternative to synthetic materials and contributing to a greener, more sustainable future.

Characteristics of Jute Fabrics

Jute fabric possesses several characteristic properties that make it a unique and versatile material.

i. Breathability**:** Jute fabric has high breathability, allowing air to pass through it easily. This property makes it comfortable to wear and suitable for applications where ventilation is important.

ii. Moisture-Wicking Abilities: Jute fabric is known for its moisture-wicking properties. It can absorb moisture from the skin and release it into the air, keeping the wearer dry and comfortable.

iii. Heat Retention: Jute fabric has medium heat retention capabilities. It can provide insulation and retain warmth, making it suitable for applications where thermal comfort is desired.

iv. Low Stretchability**:** Jute fabric exhibits low stretchability, which means it maintains its shape and structure well. This property contributes to its

durability and makes it suitable for products that require stability and resistance to deformation.

v. Resistance to Pilling: Jute fabric is resistant to pilling, which refers to the formation of small balls of fibers on the fabric's surface. This property ensures that the fabric retains its smooth appearance and remains visually appealing even with prolonged use.

vi. Strength and Durability: Jute fabric is known for its strength and durability. It can withstand wear and tear, making it suitable for applications that require robust and long-lasting materials.

vii. Environmental Friendliness: Jute fabric is an environmentally friendly material. It is biodegradable, renewable, and has a low carbon footprint, making it a sustainable choice for various applications.

viii. Coarse Texture: Jute fabric has a coarse texture that gives it a unique and distinctive appearance. This texture adds a natural and rustic charm to products made from jute fabric.

ix. UV Resistance: Jute fabric offers good resistance to ultraviolet (UV) radiation. It provides protection against harmful sun rays, making it suitable for outdoor applications.

Types of Jute fabrics & Blends

Jute fabric comes in various types, each with its own characteristics and uses. Here are the different types of jute fabric:

Burlap: Burlap is a coarse type of jute fabric with a plain weave and a rough texture. It is commonly used for packaging, sacks, and bags. Burlap's strength and durability make it suitable for heavy-duty applications.

Hessian Cloth: Hessian cloth, also known as burlap, is a lighter form of jute fabric. It has a looser weave and a smoother texture compared to burlap. Hessian cloth is often used for bags, wall coverings, and decorative purposes.

Jute Twine: Jute twine is a type of jute fabric made by twisting jute fibres together. It is commonly used for tying, wrapping, and packaging due to its strength and natural appearance.

Jute Upholstery Fabric: Jute upholstery fabric is specifically designed for furniture upholstery. It is durable, has a coarse weave, and provides a textured and natural look to sofas, chairs, and other upholstered pieces. Jute upholstery fabric can be used in its natural colour or dyed to various shades.

Production of Jute fabric

Fig. 2.11: Jute Fabrics

Jute fibre after being converted to yarns are woven into fabric. Depending on the end use of the fabric, jute can be woven in a plain weave or a variation of plain weave like basket weave or rib weave. The weaving process is the same as weaving of cotton. Jute yarn can be woven on automatic power looms, shuttle less looms or hand looms.

Preparatory Steps for Weaving

Winding: Winding is a process which provides yarn as spools and cops for the requirement of beaming and weaving operations.
There are two types of winding:

1. **Spool Winding**
2. **Cop Winding**

Spool Winding: In this process, smaller lengths of yarn are wound onto bobbins, and these bobbins are then used to create larger packages known as 'spools.' These spools play a crucial role in forming the warp portion used during the interlacement of yarn in the weaving process.

Cop Winding: A cop winding machine is used to create cylindrical packages (called cops) from yarn obtained from spinning machines. It does this by placing spinning bobbins on its spindles and maintaining yarn tension. These cops are essential for producing transverse threads in weaving. Typically, a cop winding machine has 120 spindles.

The main purpose of warp yarn winding is to transfer yarn from the spinners or doublers package to another which can be used in the creel of the warping machine. ATIRA have developed an electronic yarn clearer. This micro controller-based system is used for the detection and clearing of objectionable faults such as thick and thin places in the blends of jute yarns.

Beaming: The beaming process follows spool winding in the manufacturing of jute fabric. During this operation, yarn is wound from spools onto a beam with the appropriate width and the correct number of ends for weaving. To improve the quality of the woven cloth and the efficiency of weaving, the yarn is coated with starch paste, and maintaining adequate moisture is crucial.

Jute yarns needs to be sized because they are hairy and they have low extensibility under tension. In Indian jute industry tamarind kernel powder (TKP) is used exclusively as the only suitable sizing material. During this process, yarn continuously passes through a starch solution containing tamarind kernel powder (TKP) and an antiseptic, sodium silica fluoride (NaSiF4). The concentration of these additives varies depending on the quality of the yarn being processed.

Weaving of Jute Yarn: Weaving is a fabric production process involving the interlacement of two sets of threads known as "warp" and "weft" yarns. In the weaving section, there are distinct looms for hessian and sacking. Hessian looms require manual changing of the shuttle containing weft yarn, while sacking looms are equipped with an eco-loader for automatic cop loading into the shuttle. The following are the common looms used for weaving jute fabric:

- Shuttle Loom: The shuttle loom is the oldest type of power loom, it is effective but now-a-days it is not much used because it comes with certain disadvantage. They operate at 110 to 230 PPM which is lower than modern looms also they produce noise.
- Shuttle less Looms: Gripper projectile loom and Rapier loom can be effectively used to weave jute yarn of any nature. There is only 1 kind of projectile loom used in the jute industry. Air jet looms with either single nozzle or multiple nozzle type.
- Hand looms: The use of jute has diversified beyond traditional applications, including curtains, upholstery, and heavier furnishing fabrics produced by handloom, which are still in use.

Fig. 2.12: (a) Weaving of Jute on a Power loom (b) Weaving of Jute on a Handloom

Dyeing process of Jute fabric

Typically, dyeing of jute is of minimal significance since it is predominantly employed in its natural state within the packaging sector. Nevertheless, the contemporary utilization of jute in the textile and home furnishing industries necessitates the application of diverse dyeing techniques to impart various colors to it. Since jute is a cellulose-based fiber, it readily accepts dyes designed for cellulose fibers.

Due to the complex chemical composition of jute, presence of hemicellulose and lignin as the major constituent makes it necessary for a delicate pre-treatment. This fibre is extremely sensitive to alkali due to the presence of hemicellulose and the presence of cellulose makes it sensitive to strong acid. At every stage of chemical processing, a cautiously planned recipe is applied to retain the physical properties.

Preparatory processes for Dyeing of Jute

Fig. 2.13: Dyeing Colours

Preparatory processes are essential in dyeing jute because they ensure that the fibers are clean, free from impurities, and ready to accept and retain the dye. Scouring and bleaching are the main preparatory processes done before dyeing of jute.

- Scouring involves cleaning the fiber by removing both its natural and added impurities. Effective scouring is crucial for achieving uniform dyeing results.
- Bleaching whitens the fabric by either removing or altering the coloring matter in the fiber. In the case of jute, the primary coloring matter is lignin, which not only provides color but also acts as a binding material and enhances the fiber's strength. For deep shades, mild bleaching is sufficient but for producing light and pale shades on the fabric, full bleach is needed. Depending on the shades to be produced, the method of bleaching as well as bleaching agent can be selected. Different oxidizing and reducing agents can be utilized for bleaching of jute fabric and among them hydrogen peroxide, a non-chlorine oxidative bleaching agent, is the most popular. The bleached fabric thus produced is ready for dyeing.

Process	Chemicals used	Results
Scouring	Sodium carbonate / sodium hydroxide and non-ionic detergent	Removes natural and added impurities like sizing materials, fats, oil and waxes to make the fabric more absorbent.
Bleaching	Hydrogen peroxide, sodium silicate, sodium hydroxide and non-ionic detergent	It modifies the colouring matter present in the fabric and produce white fabric. Full bleach - Full white, sold as bleached fabric Half bleach - For pale and medium shade dyeing Quarter bleach - For deep shade dyeing

Dyeing of Jute

Direct, reactive, vat, and sulphur dyes are versatile options for dyeing jute fiber and fabric, allowing for a wide range of color options to meet specific end-use requirements. Jute's distinctive composition, including non-cellulosic constituents, makes it unique in the dyeing process. Interestingly, jute can also be dyed with various types of dyes, such as acid, basic, and metal complex dyes, without requiring any modifications. This flexibility enables the production of jute fabric with vibrant colors that remain wash fast and light fast.

Fig. 2.14: Dyeing of Jute

The basic requirements for dyeing of jute fabric are as follows:

Dyestuff	A dye applicable to jute or other cellulosic fibre must have the properties like particular shade of the colour, substantivity or affinity to the fibre and solubility in water.
Dyestuff auxiliaries	Different chemicals like salts, acids, alkalis, surface active agents, sequestering agents, buffering agents, oxidizing agents, reducing agents, etc., are used during dyeing of jute fabric are popularly known as dyestuff auxiliaries.
Jute fabric	A well-prepared jute fabric is needed for good dyeing. The fabric should be well scoured and bleached so that the dyes are applied evenly on the fabric.
Water	Water is the main medium for transportation of dye to the fibre surface and, from the fibre surface to the inside of the fibre through the fibre pores. Water is also responsible for swelling of the fibre so that the dye molecules can enter inside the fibre through the enlarged pore size on the surface of the fibre. Water used for dyeing of jute fabric must be soft so that the dyestuffs and other auxiliaries can get easily solubilised.
Machineries	Machineries are needed for even dye application, penetration and fixation of dyes on the jute fabric. Jute fabric can be dyed by either exhaustion method or padding method. Exhaustion method is more popular due to the simplicity of the application. Jigger is used for dyeing jute fabric by exhaustion method. In this machine, liquor is kept stationary and the jute fabric is kept in circulation. Jute fabric is passed from one roll to the other roll through the dye bath in forward and reverse direction several times.
Heating system	Different temperatures are needed during different steps of dyeing i.e., dye solubilisation, dye application, dye fixation, washing of dyed fabric, soaping, stripping, after treatment etc., to achieve optimum colour yield and fastness properties of the dyed fabric.

Process of Dyeing

The principles of application of different dyestuffs to jute fibre are as follows:

- Physical adsorption of water-soluble dyestuffs from an aqueous medium to jute fabric by reversible attachment to active sites present in the fibre. Direct dyes are held in jute fibre by hydrogen bonding.
- Mechanical retention of water insoluble dyestuffs in the jute fibre as in the case of vat and sulphur dyes. The dyestuffs are applied by temporary solubilisation before application to jute fibre and then reconverted to the insoluble form inside the fibre after the application.
- In case of reactive dyes, the dyes are held on the fibre by forming a covalent bond.

Fig. 2.15 : Process of Dyeing

Application of dyes on Jute

Dyeing with Direct dyes

Jute fibre has a natural affinity towards direct dye. Direct dyeing offers better exhaustion and depth of shade in shorter dyeing time. Bleached jute fabric is dyed with direct dyes at 80-90C for one hour. The dye bath contains dye, trisodium phosphate and sodium sulphate. After dyeing the fabric is washed with cold water, soaped with non-ionic detergent, again washed and finally dried in air.

Dyeing with Reactive dyes

Dyeing of jute fabric with reactive dyes involves two steps i) exhaustion and ii) Fixation. Exhaustion is carried out in the dye bath containing reactive dye and glaubers' salt. Bleached jute fabric is dipped into the dye bath and kept for one hour with stirring at 30C. After the exhaustion is over, fixation of dye is carried out by adding sodium carbonate to the dye bath. The fixation process continues for 45 minutes. Thereafter, dyed jute fabric is washed with cold water, soaped with non-ionic detergent at boil followed by usual cold washing and drying.

Dyeing with Vat dyes

Vat dyeing of bleached jute fabric involves different steps like vatting-dyeing-washing-oxidation-further washing-souring-washing-soaping-washing and finally drying. Application method of vat dye follows the steps given below:

a) Vat dye is pasted with TRO (Turkey Red Oil) and then hot water is added to the bath. Sodium hydroxide and sodium hydrosulphite are added to the vatting bath and vatting is continued for 20 min at 60C.The colour of the dye solution changes after vatting. After the vatting of the dye, required amount of water is added.

b) Further sodium hydroxide, sodium hydrosulphite, glaubers' salt are added to the dye bath and dyeing is continued for 60 min at 60C. Fabrics are then washed thoroughly in cold water and oxidized by air oxidation method or chemical oxidation method. Fabrics are washed thoroughly and soured in a bath of mild acetic acid solution for 15 min at ambient temperature.

c) After oxidation of the dyeing, the original colour of the dye is produced. Then soaping of the fabric is done at boil for 30 min in a bath containing sodium carbonate and non-ionic detergent. Ultimately the fabrics are dried in air after thorough washing with running water.

Dyeing with Sulphur dyes

Sulphur dyes are widely used for fast colours, mostly black, brown, deep blue and are applied to the fibre as substantive leuco compounds which are subsequently converted into insoluble polydisulphides inside the fibre by exposing the dyeing to air or by treating them with chemical oxidizing agents.

Sulphur dyes are reduced by using sodium sulphide, the most common reducing agent for converting the sulphur dye to the alkali soluble leuco form. Then bleached jute fabric is entered in the reduced sulphur dye bath and dyeing continued at high temperature for one hour.

As the leuco sulphur dyes are of low substantivity for jute fibre, glaubers' salt is added to improve its dye uptake. The fabric is then oxidized either in air or in chemical oxidizing bath for regeneration to the original insoluble sulphur dyes. The fabric is finally soaped at boil followed by through washing.

Dyeing with Basic dyes

Experiments have been done to dye jute fabric using Basic dyes. The process involved mixing the required amount of dyestuff and acetic acid in a closed vessel. Additional water and Sodium Acetate were added to this mixture. The jute fabric sample was then immersed in the solution, and the vessel was sealed. Dyeing was carried out at 90°C for 1 hour.

1. Finished Jute Fabric

Due to its coarse structure jute needs to be finished properly to be used in apparel and home furnishings. Jute has few drawbacks, which includes its meshy structure,

poor wrinkle recovery, high fiber shedding, susceptibility to yellowing when exposed to sunlight, vulnerability to rot, and low resistance to fire. However, various technologies have been developed to overcome these issues. These include blending jute with other textile fibers, producing fine yarn through modified spinning techniques. Additionally, functional finishes in various categories are preferred to enhance the performance of jute textiles. Textile finishing is a process employed to enhance the appearance, functionality, durability, and ease of processing of textile products.

Depending on the end use of the jute fabric special or functional finishes may be applied.

- **Crease Resistant Finish**: Crease-resistant finishes are like bonds that join together with certain parts of fibers. This makes the fibers stronger and better at bouncing back to their original shape after being stretched or wrinkled. Some important substances for this purpose include di-hydroxyethyleneurea (DHEU), dimethylol-hydroxyethyleneurea (DMDHEU), melamine, polysiloxane, and polyurethanes.

- **Rot-proof Finish**: Jute fibers are prone to fungal attacks when exposed to moisture because of the hemicellulose content and the presence of both natural and introduced impurities. Rot-resistant coatings are designed to safeguard jute textiles from the harmful effects of bacteria, fungi, and molds in adverse storage conditions, such as high humidity and elevated temperatures.

- **Antimicrobial Finish**: An antimicrobial finish is a protective treatment applied to jute fabric to prevent microbial degradation under typical environmental conditions. This susceptibility arises from the presence of hemicellulose in the jute, which makes it prone to microbial attack. Microorganisms thrive on jute when exposed to factors such as humidity, warmth, and a pH range of 6.5 to 8.5. To safeguard textile fabrics from microbial growth, specialized finishing chemicals are utilized. These chemicals serve to either destroy bacteria and fungi (referred to as bactericides) or inhibit their growth (known as bacteriostatic/fungistatic properties). The key components in these antimicrobial agents include phenolic compounds, quaternary ammonium salts, and organometallic compounds.

- **Water repellent Finish**: Water-repellent finishing is essential for jute fabric because it naturally attracts water due to its hydrophilic nature. There are two categories of water-repellent finishes: nondurable and durable. In nondurable finishes, jute materials are treated with an emulsion and then coated with hydrophobic substances like aluminum or zirconium salts or soaps. Durable finishes can be achieved by either chemically reacting the water-repellent agent with jute fibers or forming an insoluble film on the fiber's surface. Common durable water-repellent finishes include pyridinium compounds, silicones, and fluorochemical emulsions, and they are typically applied using a pad→ dry→ cure method.

- **Flame Retardant Finish**: The demand for jute-based products, such as upholstery, decorative fabrics, automotive fabric, and carpet backing, is on the rise. To meet this demand, flame-retardant finishing on jute textiles has become necessary. Flame-retardant chemicals are used to make these textiles resistant to combustion by charring the fuel, quenching combustion reactions, absorbing heat, emitting cooling gases, or replacing oxygen. Two main categories of flame-retardant chemicals are commonly used for carpets and home furnishings: phosphorous-containing flame retardants like THPC, THPS, THPOH-NH3, vinyl phosphonate, and metal complexes such as potassium hexa-fluoro-titanate and potassium hexa-fluoro-zirconate. Temporary flame retardant chemicals like borax, diammonium phosphate, and phosphoric acid are also applied along with crease-resistant or silicon finishes. The process involves scouring the jute fabrics with a sodium carbonate solution, padding them with an aqueous finishing chemical at various concentrations, drying them, and then curing them at a high temperature. Afterward, the fabrics are washed to remove untreated chemicals and air-dried. Sometimes, urea is used as a catalyst to control thermal degradation and lower the carbonizing temperature, preventing severe fabric damage. However, after flame-retardant finishing, there is a weight loss of around 20-25%, and the tensile strength of the fabric decreases by 50%.
- **Softening Finish**: Softening finishing is a preferred method to enhance the smoothness, suppleness, tensile strength, and drape-ability of textiles. Pretreatments are used to improve the compatibility between fibers and softening finishing polymers by enhancing fiber surface characteristics. These pretreatments increase fiber wettability and critical surface energy, facilitating the uniform spreading and adhesion of the polymer on the fiber surface. Jute fiber is problematic due to its harsh feel and branchy nature, making it undesirable for apparel. Softening finishes are necessary to create a uniform film on the jute fiber's surface, improving its appearance and softness in jute-based textiles.
- **Ultraviolet Protection Finish**: Exposure to sunlight can cause jute fibers to become discolored or yellowed due to chemical reactions involving lignin and cellulose/hemicellulose bonds, as well as methoxyl splitting from lignin. To prevent this yellowing, it is possible to apply organic and inorganic ultraviolet absorbers during the dyeing or finishing process. These absorbers help protect the jute fibers from the harmful effects of ultraviolet (UV) radiation, while preserving their natural color.

2. Benefits and uses of Jute

Jute fabric offers many advantages owing to its sustainable characteristics, cost-effectiveness environmental friendliness, and versatility.

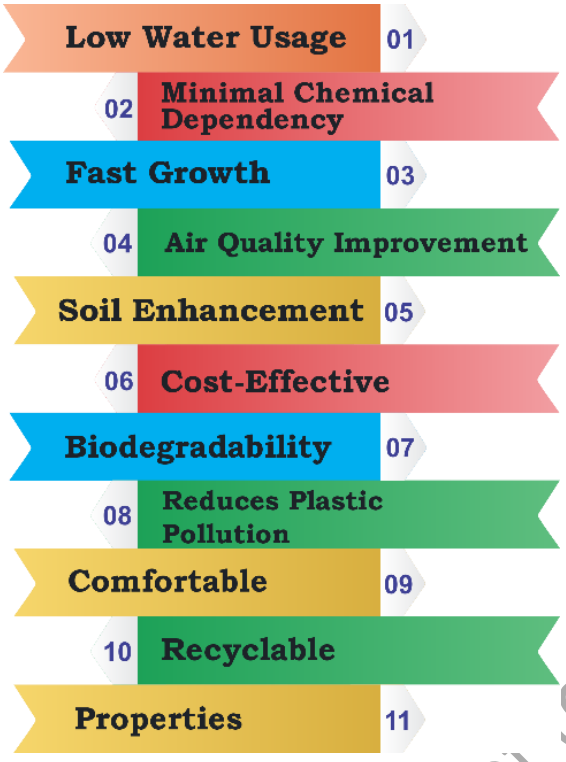


Fig 2.16: Benefits and user of Jute

Benefits of Jute

1. **Low Water Usage**: Jute requires very little water for growth, making it a sustainable choice, especially in regions focused on water conservation.
2. **Minimal Chemical Dependency**: Jute grows well with minimal need for fertilizers, herbicides, and pesticides, reducing chemical pollution in the soil.
3. **Fast Growth:** Jute has a short growing season of about 100 days, providing a continuous supply of fiber, with the ability to be harvested every 4 to 6 months and yield between 20 and 40 tonnes per hectare. Jute cultivation requires less land than cotton farming, with a single hectare yielding significantly more jute fiber.
4. **Air Quality Improvement:** Jute plants can absorb significant amounts of carbon dioxide and release oxygen during their growing season, contributing to cleaner air.
5. **Soil Enhancement:** Jute replenishes soil nutrients and reduces the risk of pests and diseases, benefiting future crops in crop rotation systems. After a jute crop, the leaves and roots of jute plants remain in the field, enriching the soil and improving its texture.
6. **Cost-Effective:** Jute cultivation is cost-effective due to its minimal requirements for fertilizers and pesticides, and it yields a substantial crop in a small area.
7. **Biodegradability:** Jute is biodegradable, allowing it to decompose naturally when it reaches the end of its life cycle.

8. **Reduces Plastic Pollution:** Jute-based reusable shopping bags are eco-friendly alternatives to single-use plastic bags, helping reduce plastic pollution. Jute fabric serves as a superior substitute for combating toxic waste, replacing plastic bags to prevent environmental pollution.
9. **Comfortable:** Jute, when woven into fabric, provides comfort, making it suitable for clothing and reusable bags. Jute can also be blended with other fibers, both natural and synthetic, and can be dyed using various classes of dyes, including natural, basic, vat, sulfur, reactive, and pigment dyes.
10. **Recyclable:** Jute can be recycled multiple times, ensuring ongoing use of existing fibers and reducing waste.
11. **Properties**: Jute has high tensile strength, low extensibility, and excellent breathability, good insulation and antistatic properties, low thermal conductivity, moderate moisture retention, and acoustic insulation.

Application of Jute fabric

a. **Packaging Material:** Jute fabric is extensively used for making bags and sacks due to its strength, durability, and breathable nature. In India, jute has traditionally been used as a packaging material, farmer market bags, grocery bags, shopping bags, floor mats, ropes, and twines. Jute fabric's strength and durability have made it a preferred choice for packing bags and sacks for many years.

Fig 2.17: Packaging Material

b. **Upholstery:** Jute fabric is used in upholstery for sofas, chairs, and other furniture. Jute upholstery fabric is known for its durability and resistance to wear and tear.

Fig 2.18: Chair of Jute Fabric

c. **Carpets and Rugs:** Jute fibres are woven into carpets and rugs, offering a natural and earthy aesthetic to floors. Jute carpets and rugs are known for their durability and can be used in residential and commercial settings.

Fig 2.19: Jute Rug

d. **Curtains and Window Treatments:** Jute fabric is used to create curtains and window treatments, adding a touch of natural elegance to windows. Jute curtains provide privacy while allowing light to filter through. They are commonly used in rustic and eco-friendly interior designs.

Fig 2.20: Jute Curtain

e. **Geo Textile:** Jute Geotextile (JGT) is a versatile material used in various applications such as controlling surface soil erosion on slopes and plains, stabilizing embankments, reinforcing road subsoils, protecting river and waterway embankments, facilitating underground drainage, and reinforcing soft ground. In construction, JGT serves multiple functions including preventing the mixing of different soil layers, acting as a separator, filtering, and controlling landslides, while also bearing loads when necessary. It is commonly employed for slope stabilization, soil erosion prevention, and landscaping projects. Jute fabric acts as a protective layer, preventing soil erosion caused by wind and water.

f. **Home Textiles:** Jute home textiles include multi-colored and processed jute or jute/cotton upholstery, table runners, placemats, cushion covers, throws, tapestry, wall coverings, floor coverings, floor mats, soft suitcases, aprons, hats, gloves, folder covers, shoes, tablecloths, patchwork, weaving, gift boxes, and various handicrafts. Additionally, there are environmentally friendly jute upholstery fabrics and tarpaulins made from jute or mixed materials. Overall, these products showcase the versatility and eco-friendliness of jute as a material for various applications. Jute's natural texture and earthy appearance add warmth and rustic touch to interior spaces.

Fig 2.21: Jute cushion cover and bedsheet with pillow case

g. **Fashion and Accessories:** Jute fabric is used in the fashion industry to create accessories such as hats, bags, belts, and footwear.

Fig 2.22: Jute Had

h. **Crafts and Do-it-yourself (DIY) Projects:** Jute fabric is popular among craft enthusiasts. It is used for various crafts, including wreaths, gift wrapping, wall hangings, and jewellery. Jute's natural appearance and versatility make it a favourite choice for creative projects.

Fig 2.23: Jute DIY Products

i. **Composite material:** The use of jute fiber in polymeric matrix composites has opened up new opportunities for construction materials. Jute composites are cost-effective and find applications in constructing items like ceiling panels, door frames, and even pre-fabricated buildings for disaster-prone areas.

j. **Jute Furniture:** Jute furniture is gaining popularity worldwide due to its natural, stylish, and durable qualities. Today, wholesale suppliers,

manufacturers, and exporters of jute furniture offer a comprehensive range of products, including jute chairs, stools, and tables, lounge chairs, beds, sofa sets, office furniture, hotel furniture, room dividers, cafeteria chairs and tables, mattresses, portable beds, hammocks, hanging chairs, shoe racks, multipurpose racks, and more. Jute furniture offers longevity with minimal maintenance and is resistant to water damage and rust. It's suitable for outdoor spaces like backyards or terraces and enhances the aesthetics of interiors. Jute furniture is affordable, durable, and adaptable to various designs.

Fig 2.24: Jute Sofa-Set

k. **Agro-textile:** Jute fabrics have a wide range of applications, including use as sunscreens, plant nets, windscreens, harvest nets, field nets for protecting crops from birds, weed control, seed mulching, soil conservation, and forest development in semi-arid regions.

Activities

Prepare a flow chart of fiber to fabric for jute.

Materials Required:

- A4 size paper or chart paper
- Colored pens or markers
- Ruler
- Pencil
- Eraser
- Reference materials on jute processing (textbooks, online resources)

Procedure:

1. Collect the required information, and pictures.
2. Ask your teacher about flow chart and how to make it.

Organize the collected information in the form of a flow chart.

Industry visit to understand the processing and production of jute fabric
Prepare a flow chart of fiber to fabric for jute.

Developing a swatch file by collecting different jute fabrics

Check Your Progress

Fill in the Blanks

a. The first preparatory process where fibre is made clean by removing its natural and added impurities is known as _____.

b. In Indian jute industry _____ is used exclusively as the only suitable sizing material.

c. _____, _____, _____, _____ dyes can be applied on jute fabric to produce variety of shade depending on the end use requirement.

d. Experiments have been done to dye jute fabric using _____.

A machine known as _____ is used for dyeing of jute fabric by exhaustion method.

True Or False

a. Jute fabric known as burlap is commonly used for packaging, sacks, and bags due to its smooth texture. (True or False)

b. Jute twine, made by twisting jute fibers together, is primarily used for furniture upholstery due to its strength and natural appearance. (True or False)

c. Jute yarns can be woven into fabric using automatic power looms, shuttleless looms, or hand looms, similar to the weaving process of cotton. (True or False)

d. In the dyeing process of jute fabric, the presence of hemicellulose and lignin in jute requires careful pre-treatment before applying diverse dyeing techniques. (True or False)

e. Jute fabric can be dyed with various types of dyes, including acid, basic, and metal complex dyes, without requiring any modifications. (True or False)

Question Answers

a. Briefly describe the weaving process of jute fabric.

b. What types of looms can be used for weaving Jute?

c. List the dyes suitable to dye jute fabric.

d. What are the basic requirements for dyeing the jute fabric?

e. Give the process for dyeing of jute with reactive dyes.

Session 3: Describe Jute Recycling

Jute, often referred to as the "golden fiber," has been an integral part of India's industrial and agricultural landscape for centuries. With its various applications in textiles, packaging, and handicrafts, jute is not only a vital economic resource but also a symbol of sustainable living. In recent years, the concept of recycling jute has gained momentum as a means to address environmental concerns and promote circular economies. Due to its impact on environment and recycling ability, jute is considered as sustainable.

The Indian government has taken steps to promote jute recycling and sustainable practices. Incentives, subsidies, and awareness campaigns have been launched to encourage industries and consumers to participate in recycling initiatives. Recycling jute in India represents a holistic approach to addressing environmental concerns, fostering economic growth, and promoting sustainable living. By embracing the principles of recycling, India can make significant strides toward a greener future while preserving its heritage as a jute-producing nation.

Recycling jute is a sustainable practice that can help reduce waste, conserve resources, and minimize the environmental impact of jute production and disposal. Jute is a natural fiber derived from the stems of the jute plant, and it is commonly used to make products like bags, ropes, textiles, and more. The following are some key aspects of recycling jute for sustainability:

Fig 2.25: Jute Recycle

1. **Reusing Jute Products:** Jute bags and products can often be reused multiple times before they wear out. Encouraging consumers to reuse jute bags for shopping, storage, or other purposes can extend their lifespan and reduce the need for new jute products.

2. **Repurposing:** Old or damaged jute products can be repurposed into new items. For example, old jute bags can be transformed into decorative items, cushion covers, or even used for creative DIY projects.

3. **Composting:** Jute is a biodegradable material, and when it reaches the end of its useful life, it can be composted. Composting jute products can help enrich soil and reduce landfill waste.

4. **Fiber Recovery:** Jute fibers can be mechanically or chemically extracted from old jute products and used to make new jute products. This process reduces the need for virgin jute fibers and conserves natural resources.

5. **Jute Recycling Programs:** Governments, NGOs, and businesses can establish jute recycling programs to collect and process old jute products. These programs can raise awareness about the benefits of recycling jute and provide convenient drop-off points for consumers.

6. **Sustainable Jute Production:** To support jute recycling efforts, it's important to ensure that jute is grown and processed using sustainable practices. Sustainable jute farming includes techniques like crop rotation, reduced pesticide use, and efficient water management.

7. **Education and Awareness:** Educating consumers and businesses about the environmental benefits of recycling jute is essential. Promoting sustainable practices and responsible consumption can lead to increased recycling rates.

8. **Research and Innovation:** Research into innovative recycling and upcycling techniques for jute can lead to more efficient and eco-friendly ways to reuse jute materials.

9. **Collaborative Efforts:** Collaboration among government agencies, industry stakeholders, and environmental organizations can help create a comprehensive approach to jute recycling and sustainability.
   Recycling jute not only reduces waste but also contributes to a more sustainable and environmentally friendly supply chain for this natural fiber. It is an important step in minimizing the environmental impact of jute production and consumption.

10. **Environmental Significance:** The environmental impact of non-biodegradable materials like plastic has led to a growing interest in sustainable alternatives. Jute, being a natural fiber, is biodegradable and does not contribute to long-lasting pollution. By recycling jute products, India can significantly reduce its carbon footprint and alleviate the pressure on landfills.

Jute Recycling Processes

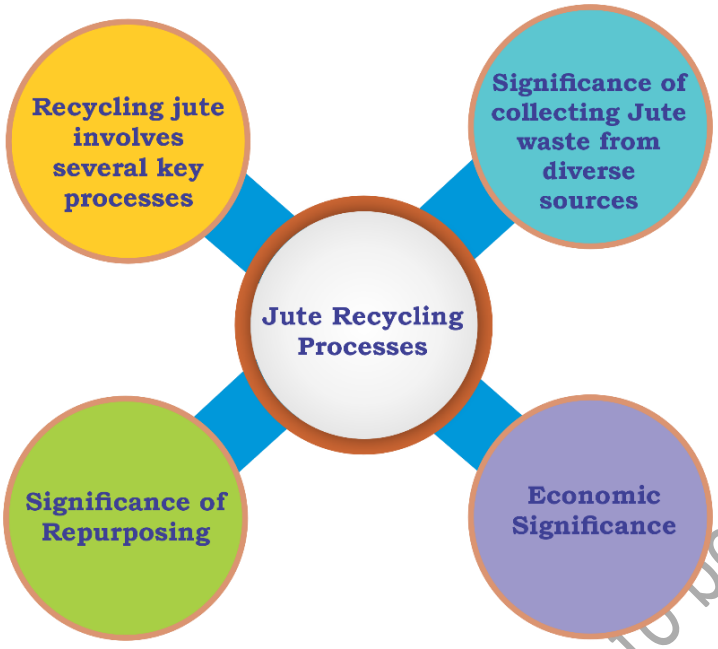


Fig 2.26: Jute Recycling Process

Recycling is the process of collecting and reprocessing materials that have been used, with the aim of converting them into new products or materials. When we discuss jute recycling, we are specifically referring to the practice of reusing jute-based items, such as bags and sacks.

The importance of jute recycling lies in its environmental and sustainability benefits. Jute, being a natural and biodegradable fiber, is favored for its eco-friendliness. However, the production of new jute products demands substantial resources and energy. By engaging in jute recycling, we contribute to the conservation of these resources and the reduction of waste in our ecosystem.

In essence, jute recycling represents an eco-conscious approach to both extending the life of jute-based items and reducing the ecological footprint associated with the production of new jute products. It aligns with the principles of sustainability and responsible resource management.

Recycling jute involves several key processes:

i. **Collection:** Used jute products, such as sacks, bags, and clothing, are collected from various sources, including households, industries, and agricultural fields. The collection phase of recycling jute is the first step on the path to transforming discarded jute items into valuable recycled materials. This process involves sourcing used jute products from a diverse range of locations, each playing a crucial role in contributing to the recycling ecosystem.

- **Households:** Households serve as a primary source of used jute products for recycling. Everyday items like jute sacks, bags, and even clothing items that have reached the end of their usable life are often found in households. These items might come from grocery shopping, packaging, or worn-out

fashion accessories. Encouraging proper disposal and segregation at the household level forms the foundation of effective jute recycling.

- **Industries:** Industries that rely on jute for packaging materials, such as agriculture and food processing sectors, generate a significant amount of used jute products. Discarded jute sacks and bags from these industries can be collected and recycled to contribute to a sustainable supply of jute-based materials. Collaborative efforts between industrial stakeholders and recycling initiatives are vital to ensure the efficient collection of these valuable resources.
- **Agricultural Fields:** The agricultural sector, which is intertwined with the history of jute cultivation, offers another avenue for collection. Jute fibers are initially derived from jute plants grown in fields. After serving their purpose, these plants generate waste that can be collected and repurposed. By involving farmers and agricultural workers in the collection process, the cycle of jute's lifecycle is completed, creating a closed-loop system.
- **Commercial Establishments:** The fashion industry, which holds a special place in your passion for fashion, also contributes to the collection process. Discarded jute clothing items, fashion accessories, and textile remnants can find a new lease on life through recycling. Retail outlets, boutiques, and textile-related businesses can participate in the collection effort, redirecting jute fashion waste from landfills.

Significance of collecting Jute waste from diverse sources:

- **Resource Maximization:** The diversity of collection sources ensures a steady stream of used jute products for recycling. This maximizes the utilization of available resources and reduces the need for virgin jute materials, thus conserving the natural environment.
- **Awareness and Participation**: Involving different sectors of society, from households to industries, fosters awareness about the importance of jute recycling. It encourages widespread participation, making jute recycling a shared responsibility.
- **Circular Economy Promotion:** By collecting used jute items from various sources, we contribute to the circular economy concept. Materials are collected, processed, and transformed into new products, reducing waste and environmental impact.
- **Sustainability:** The collection process aligns with sustainable waste management practices. It prevents used jute products from ending up in landfills, reducing the burden on waste disposal systems.

ii. **Sorting:** The collected jute items are sorted based on their condition and type. This ensures that only suitable materials are chosen for recycling.

iii. **Cleaning:** The sorted jute products are thoroughly cleaned to remove dirt, contaminants, and any residual substances.

iv. **Reconditioning:** Depending on the intended application, recycled jute may undergo processes to restore its texture, strength, and appearance.

v. **Repurposing:** Recycled jute can be transformed into a range of products, including eco-friendly textiles, handicrafts, paper, and even innovative construction materials.
The repurposing stage of jute recycling is where the magic truly happens. Collected used jute products, which may have served their initial purposes, are given a fresh lease on life through creative and sustainable transformation. This phase not only reduces waste but also showcases the remarkable versatility of jute as a renewable resource.

- **Eco-Friendly Textiles:** Recycled jute is spun into threads and woven to create eco-friendly textiles with a distinct texture and appearance. These textiles find their way into various fashion and lifestyle products. From clothing and accessories to home decor items like curtains and upholstery, jute-based textiles offer a unique blend of rustic charm and modern appeal.
- **Handicrafts:** The handcrafted industry witnesses a renaissance with recycled jute. Skilled artisans transform jute fibers into intricate handicrafts, such as bags, baskets, rugs, and wall hangings. These products not only showcase traditional craftsmanship but also carry a story of sustainability and resourcefulness.
- **Paper Production:** Jute fibers can be used to create eco-friendly paper, perfect for stationery, packaging materials, and even notebooks. This repurposing of jute into paper adds a natural touch to products while contributing to reducing the demand for traditional wood-based paper production.
- **Innovative Construction Materials:** The innovative potential of jute extends to the construction industry. By combining jute fibers with binders and other materials, sturdy construction materials like panels and boards can be produced. These materials offer thermal insulation and structural integrity, making them a sustainable alternative in building projects.
- **Eco-Friendly Furniture:** Jute fibers can be incorporated into furniture design, creating unique and sustainable pieces. From chairs with jute-woven seats to tables adorned with jute-based accents, these furnishings add an eco-friendly touch to interior spaces.
- **Bio-Based Packaging:** Recycled jute can also be used to create packaging materials, offering a bio-based alternative to traditional plastic packaging. Bags, pouches, and containers made from jute fibers contribute to reducing single-use plastic waste.

Significance of Repurposing:

- **Resource Conservation:** Repurposing used jute items conserves resources by extending their utility beyond their initial purpose, reducing the need for new raw materials.

- **Environmental Impact:** The production of jute-based products has a lower environmental footprint compared to products made from non-renewable resources.
- **Promotion of Sustainable Lifestyles:** Jute-based products encourage sustainable consumer choices, as they align with eco-friendly values and a desire for unique, handcrafted items.
- **Economic Opportunities:** Repurposing used jute generates economic opportunities, supporting artisans, manufacturers, and entrepreneurs involved in creating a wide range of products.

Economic Significance:

The recycling of jute not only benefits the environment but also has positive economic implications:

- **Employment Opportunities**: Jute recycling fosters job creation, especially in rural areas where jute cultivation and processing are prevalent. This contributes to rural development and poverty alleviation.
- **Value Addition:** The recycled jute products offer unique value propositions in the market due to their sustainable nature, making them attractive to environmentally conscious consumers.
- **Export Potential:** India has a rich history of jute production and is one of the largest exporters of jute products. By recycling jute, India can enhance its export offerings and strengthen its position in the global market.

Activities

Prepare a chart on jute recycling process.

Materials Required:

- A4 size paper or chart paper
- Colored pens or markers
- Ruler
- Pencil
- Eraser
- Reference materials on jute processing (textbooks, online resources)

Procedure:

3. Collect the required information, and pictures.
4. Ask your teacher for the directions about how to prepare the chart.

Organize the collected information in the form of a chart.

Check Your Progress

True Or False

1. The concept of recycling jute has gained momentum as a means to address environmental concerns and promote circular economies. (True or False)
2. Jute, due to its impact on the environment and recycling ability, is not considered sustainable. (True or False)
3. The Indian government has taken steps to promote jute recycling and sustainable practices. (True or False)
4. Recycling jute primarily involves repurposing old or damaged jute products into new items. (True or False)
5. Jute fibers cannot be composted at the end of their useful life. (True or False)

Fill in the Blanks

1. Jute recycling programs can be established by_____, NGOs, and businesses to collect and process old jute products.
2. Jute recycling has _____economic implications, including job creation and enhanced export potential.
3. Jute is a _____material, and when it reaches the end of its useful life, it can be composted.
4. Jute fibers can be mechanically or chemically _____from old jute products and used to make new jute products.
5. Governments, NGOs, and businesses can establish jute _____programs to collect and process old jute products.

Question Answers

1. What are some of the important applications of Jute?
2. Why jute waste is collected for recycling from diverse sources?
3. What are the different ways that recycled jute can be reused for sustainability?
4. Why is repurposing of Jute significant?
5. What are the significant economic reasons for jute recycling?

Module 3:	Handicrafts, Handloom and Jute Industry

Module Overview

India is known for its vibrant and exquisite craftsmanship for handlooms and handicrafts since ancient times. The richness of Indian crafts can be dated back to about 5000 years back and is visible in the excavated findings of the Indus Valley Civilization. There are a wide range of crafts and textiles in India specific to different regions and are created by skilled craftsmen who utilize their ingenuity, passion, skill and traditions for creating these masterpieces. Indian craftsmen possess skill and knowledge of diverse techniques such as painting, printing, resist dyeing embroidery, and weaving that have been handed down to them by their ancestors. The talent, commitment, and creativity that go into the making of handlooms and handicrafts come from centuries-old customs. The manufacturing process is very laborious, tedious and hence these products are expensive.

In recent years, there has been a growing recognition of the importance of supporting and promoting Indian handicrafts and handlooms, both for their cultural significance and their economic impact on local communities. Government initiatives, NGOs, and the private sector have been working together to provide artisans with better access to markets, training, and resources to help sustain these age-old traditions and make them more economically viable in the modern world.

Learning Outcomes
After completing this module, you will be able to: • Explain handicrafts, handloom and jute industry • Analyze and describe scope of jute industry • Identify jute market, consumers and governing bodies
Module Structure
Session 1: Introduction and orientation to jute products artisan
Session 2: Various tools and equipment used in jute industry
Session 3: Production process of jute products with reference to handicrafts industry

Session 1: Explain Handicrafts, Handloom and Jute Industry

Introduction to Handloom and Handicraft Industry and its Structure

The handloom and handicraft sector are one of the important pillar of our country's economy. It is environment friendly and sustainable as it requires low capital

investment, uses locally available raw material and generates local employment. Production of handlooms and handicrafts falls under unorganized sector and thus has no formal structure. Mostly the production takes place in rural or semi urban areas. The importance of handloom and handicraft sector can be understood from following:

1. The handicraft and handloom industry are a significant source of economic activity and income generation.
2. It serves as an additional source of income to rural and agrarian communities. In times of agrarian trouble, the handloom and handicraft sector offers a low-cost, environment friendly way of life with economic support.
3. The weaves and crafts provide the weavers and artists a sense of identity.
4. The crafts and weaves of the handicraft and handloom sector represent the traditional wisdom and knowledge. Together they represent the treasure of knowledge and skills acquired over a long period of several centuries.
5. The handicraft and handloom sector can help in combating the widespread underemployment and unemployment in rural areas caused by an overreliance on agriculture. The non-farm activities such as handicraft and handloom can help in generating employment for rural and marginalized sections of the society.
6. These sectors could help the country achieve the United Nations Sustainable Development Goals (SDGs), to which our country is also a signatory.
7. These industries are relatively less polluting than other industrial manufacturing activities because they use natural raw materials and need less machinery as mostly the production involves manual and hand labour.

What are Handicrafts?

The word handicraft is used to describe a wide variety of products that are made by artisans either by hands or with the help of hand operated tools. Sometimes machines can also be used but the direct involvement of artisans and their manual work is the mandatory requirement for any product to be called as handicraft. This sector is characterized by the use of local resources and assistance, family tradition, small-scale enterprise, labor-intensive, traditional techniques and skills that are usually passed down from one generation to another and are not learnt in formal schools. The handicraft markets and enterprises operate in an unorganized environment. These products can be utilitarian or aesthetic or both. Indian Handicrafts are a major source of export earnings and play an important role.

Fig. 3.1: Handicrafts

Indian handicrafts play a very crucial role in India's economic growth as they are a source of export earnings, employment and a symbol of our cultural heritage. This sector can bring prosperity to the country. It is a major source of livelihood for many marginalised communities and helps them to meet their basic needs. One of the biggest advantage of handicraft industry is that it is skill based and requires no formal education. Also, it can be a great source of additional income supplementing the agricultural incomes of farming communities, especially women and people from the poorer parts of society. The data on the exports of all Indian handicrafts show how the sector has grown to become one of the nation's main sources of foreign exchange gains. From the Indus Valley Civilization to modern artisan goods, Indian Handicrafts have a long and illustrious history. A large number of people are needed to work in the craft industry, which is widespread throughout the nation in both rural and urban locations.

India is a significant source of handicrafts for the global market. The Indian handicrafts industry is a cottage-based, highly labor-intensive, decentralized sector that is dispersed throughout rural and urban areas of the nation. A large number of craftsmen work at their crafts full-time and part-time. Handicrafts have enormous potential since they are essential to supporting both the millions of artisans who already exist in the country and the growing number of newcomers who are joining the crafts industry. Currently, handicrafts significantly contribute to the creation of jobs and exports.

Handicrafts can be broadly classified into following categories:

1. Utilitarian Articles that is articles of everyday use
2. Decorative articles such as gifts, souvenirs, show pieces

A variety of media are used by the craftspeople to show their creativity. These include textiles, precious and semi-precious metals, wood, valuable and semi-precious stones, ceramics, and glass apart from a host of other materials.

Clay, Metal, and Jewelry: Metals such as brass, copper, bronze is used for a wide range of products and have a wide range of finishes. Scintillating ornaments come in a broad variety of designs, compositions, and styles and can be made of silver, gold, copper or even clay. These decorations include both classic and contemporary designs and are made from precious metals, base metals, and precious and semi-precious stones. Apart from jewelry clay and metal are also used for making toys,

- Woodwork: In India, wooden objects can be either intricately carved or have very basic design. Toys, furniture, ornamental items, and other items can all be found bearing the artistry and uniqueness of the maker. India is renowned for its lacquered wood products in particular.
- Stone Craft: The rich legacy of Indian stone crafts is continued by the finely carved stoneware such as statues, utensils, vases and other decorative items made of marble, alabaster, soapstone, etc., inlaid with semiprecious stones.
- Glass and Ceramic: Products made of glass and ceramic are a quickly growing category of Indian handicrafts. There is a nostalgic impression brought on by the glass's traditional mouth-blowing manufacturing process. The many hues and shapes of porcelain and glass would complement Western aesthetics while still having an Indian feel to them.

Art metalware	:	Uttar-Pradesh (Moradabad, Sambhal, Aligarh) Haryana (Rewari, Jagadhri) Rajasthan (Jodhpur, Jaipur, Jaisalmer) Delhi, Karnataka (Bidar), Tamil Nadu (Thanjavur, Chennai) and Kerela (Thiruvananthapuram) etc.
Wooden Art Wares	:	Uttar Pradesh (Saharanpur, Nagina, Varanasi) Punjab (Hoshiarpur, Amritsar) Rajasthan (Jaipur, Jodhpur) Chhattisgarh (Jagdalpur) Karnataka (Bengaluru, Mysuru, Chennapatna) Tamil Nadu (Chennai) Odisha (Berhampur)
Hand painted and printed textiles	:	Rajasthan (Bagru, Sanganer, Pipad, Nathdwara) Madhya-Pradesh (Bagh) Gujarat (Nirona, Ahmedabad) Andhra-Pradesh (Shrikalahasti, Machlipattnam) Uttar-Pradesh (Pilkhuwa, Farrukhabad)
Thread and Zari Embroidery Textiles	:	Jammu-Kashmir (Srinagar), Punjab (Amritsar, Patiala, Hoshiarpur) Uttar Pradesh (Lucknow, Rampur, Aligarh) Delhi, Gujarat (Ahmedabad. Kutch and Kathiawar), Madhya Pradesh (Bhopal), Tamil Nadu (Toda), Andhra Pradesh (Lambadi) West Bengal (Kolkata), Karnataka (Bijapur, Dharwad) Maharashtra (Aurangabad)
Woven Textiles	:	Jammu-Kashmir (Srinagar), Uttar Pradesh (Varanasi) Delhi, Gujarat (Ahmedabad. Patan), Madhya Pradesh (Maheshwar, Chanderi), Tamil Nadu (Kanchipuram), West Bengal (Shantipur, Kolkata), Karnataka (Bijapur, Dharwad) Maharashtra (Paithan, Aurangabad)
Marble & Soft Stone Crafts	:	Uttar Pradesh (Agra), Rajasthan (Jodhpur), Tamil Nadu (Chennai), Chhattisgarh (Bastar)
Papier Mache Crafts	:	Jammu-Kashmir (Srinagar) Rajasthan (Jaipur)
Terracotta	:	Uttar Pradesh (Agra), Rajasthan (Jodhpur), Tamil Nadu (Chennai), Chhattisgarh (Bastar)
Imitation jewelry	:	Delhi, Uttar-Pradesh (Moradabad, Sambhal), Rajasthan (Jaipur) Nagaland (Kohima)
Artificial Leather Goods	:	Madhya Pradesh (Indore), Maharashtra (Kolhapur), West Bengal (Shanti Niketan)

What are Handlooms?

A loom is a device on which fabric is woven. Hand operated loom is called a handloom. Handloom weaving is a very time consuming and laborious process and each handwoven piece of textile is unique and exquisite. India is home to some of the finest and most handlooms such as banarasi brocade, paithani, kanjeevaram, chanderi, Maheshwari, Ikat and so on and so forth.

Fig 3.2 Handloom

The handloom industry is one of the largest cottage industries and it occupies a place of prominence in the economy of India. Although the handloom industry is spread all over India, it is concentrated mainly in Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Rajasthan, Orissa, Karnataka, Bihar, Tripura, Kerala, Madhya Pradesh and Maharashtra.

Due to its unique nature of requiring very less working capital, very low or no power usage and environment friendly operations along with availability of manual labour and natural resources in India, the handloom and handicraft industry has thrived since thousands of years.

Handloom and Handicraft Industry jointly generate large scale employment and also provide a source of supplementary income. The Indian Handloom and Handicraft industry uses locally available raw material such as cotton, silk, jute, wool, wood, marble, iron and other natural materials. Now that we know the importance of handloom and handicrafts, let us understand the use of jute in this vital sector.

Introduction to Jute and its products:

We all know that India is one of the leading jute producers of the world, thus it is used widely in packing, geotextiles as well as handloom and handicraft industry. The government is also promoting its use in various sectors as it provides employment to a large number of people. In India Jute is used extensively in Industry as well Handicrafts and Handloom sector. Let us now understand its various uses:

Scenario of Jute Industry in India

Jute is a traditional industry in India. Over the years its importance has increased. Its importance is increasing as the fashion industry is moving more towards sustainability and circular fashion.

Fig: 3.3 Jute in India

India is one of the biggest producers of jute and the jute industry in India is approximately 168 years old. It was in 1855 that the first Jute Mill was established in India at Rishra, (West Bengal) beside the river Hooghly. At present there are about 104 jute mills in our country. West Bengal has the maximum number of jute mills. More than 1.5 million people in our country depend on jute and related fiber farming, trade, and manufacturing for their livelihoods. (Source of Data: CACP, Price Policy for Jute 2023-24 Season)

INDIAN JUTE- AT A GLANCE			
1	1. Average land area under Raw Jute (Jute + Mesta Cultivation) (Average of last four years)	:	673 thousand hectares *
2	Average production of Raw Jute (Jute + Mesta) (Average of last four years)	:	9,718 thousand bales of 180 Kgs each (17,49,240 MTs)
3	Number of composite Jute Mills	:	104
4	State-wise distribution of composite Jute Mills	:	West Bengal 75 Andhra Pradesh 14 Bihar 4 U.P. 3 Assam 2 Orissa 3 Chhattisgarh 2 Tripura 1
5	Number of workers employed in composite jute mills (as on 31st December 2022)	:	46,487 approx (permanent workers) 1,08,461 approx (other workers)
6	Average production of jute goods in composite jute mills (Average of last four years)	:	1113.6 thousand tonnes per annum
7	Average export of jute goods [Average of last four years 2019-20 to 2022-23 (Oct 22)]	:	121.3 thousand M.T. per annum with value of Rs. 27687 million per annum
8	Average domestic demand for jute goods (Average of last four years)	:	1051.4 thousand tonnes per annum
9	Government of India-owned jute mills under control and management of National Jute Manufactures Corporation Ltd.	:	Alexander, Khardah, Kinnision, National, RBHM & Union (Presently, all six mills are Closed)
10	100% export-oriented units (as on 31st March, 2023)	:	Cheviot Co. Ltd. (Falta SEZ)
11	Installed looms in jute mills (as on 31st March 2023)	:	47,146 Hessian 14,795

			Sacking 22,801 CBC 584 Others 8,966
12	Installed spindles in jute mills other than 100% export- Oriented units (as on 31st March 2023)	:	7,60,624 Fine 6,19,802 Coarse 1,40,822
13	Installed capacity of composite jute mills other than 100% Export oriented units. (On the basis of 305 working days per Year & JMDC (Productivity Norms) (as on 31st March 2023)	:	2,769 thousand tonnes per annum
***As Per First Advance Estimates, DES, GoI (Source –CACP, Price Policy for Jute 2023-24 Season)**			

In India West Bengal, Orissa, Bihar, Assam, Meghalaya, Tripura and Andhra Pradesh are the major jute producing states. There are 33 odd districts spanning West Bengal, Orissa, Bihar and Assam, which account for 98.43 percent of the total raw jute production in the country. Nadia, Murshidabad, Cooch Behar, Dinajpur, Jalpaiguri, North 24 Parganas, Hooghly and Malda districts in West Bengal account for 71 percent of area under jute cultivation in India and 73.09 percent of the total raw jute production in the country.

Jute industry is depended on huge and cheap labour. It supports round 40 lakh farm families and provides direct employment to 2.6 lakh industrial workers and 1.4 lakh in the tertiary sector.8 It was dependent on migrant labors from the initial days. The industry attracted immigrant labors from outside of West Bengal, especially from Orissa and Bihar.

Uses of Jute: It has multiple uses. It is used majorly in packaging. However, in the last few years it has also been used in geotextiles and apparel sector. It is used to make twine, rope and mat. In combination with sugar, the possibility of using jute to build aero plane panels has also been considered. Jute matting is used to prevent flood erosion while natural vegetation becomes established. For this purpose, a natural and biodegradable fiber is essential. Jute is used chiefly to make cloth for wrapping bales of raw cotton and to make sacks and coarse cloth, Jute fibers are also being used to make pulp and paper. Jute is used in the manufacture of a number of fabrics, such as Hessian cloth, Sacking, Scrim, Carpet backing cloth and Canvas. Diversified jute products are becoming more and more valuable to people, because it is being used to make Espadrilles, Soft Sweaters. After coverings home textiles, Geo textiles, Composites and more. Its UV protection, sound and Heat insulation low thermal conduction and anti-static properties make is a wise choice of people.

Jute fabric is also used in the fashion industry to create clothing and accessories. Jute clothing has a natural feel, and is especially popular in bohemian and rustic designs.

Traditionally jute has been used for making hessian cloth, burlap, gunny bags, jute yarn and carpet backing. It's also widely used in India's handicraft industry for making handicraft items such as mats, rugs, souvenirs etc.
The jute bag market has been experiencing continuous growth. The rising preference of consumers for eco-friendly products currently represents one of the primary drivers resulting in the increasing sales of jute bag. Jute bags are eco-friendly and biodegradable, which makes them an ideal substitute for ~~w~~ plastic bags. Consumers are becoming increasingly conscious of the impact of their choices on the environment and society and preferring jute bags to reduce their carbon footprint. As a result, retailers and manufacturers are shifting toward developing and improving eco-friendly packaging solutions, including jute bags, to cater to the changing consumer preferences.

Raw Jute: Raw Jute Raw jute crop is an important cash crop to the farmers. Cultivation of raw jute crop provides not only fibre, which has industrial use, but also jute stick which is an important fuel to the farming community. Raw jute is produced mainly in the States of West Bengal, Bihar, Assam, Orissa, Andhra Pradesh, Tripura and Meghalaya.
Jute Goods:

Fig. 3.4: Raw Jute, Jute Yarn and Fabric and Jute Goods

Fig. 3.5: Jute Handicrafts

Ahmad et al. [1], in their research findings, highlights handicrafts as a pivotal source of revenue generation of the Jammu & Kashmir states. This industry is unique in terms of design, cost and quality of products and thus provides a competitive

advantage over other National and international players of the handicrafts market. In spite of the various advantages, the industry needs to explore and identify various opportunities and challenges ahead.

Unique features and future prospects of jute industry

Today, jute can be defined as an ecofriendly natural fibre with versatile application prospects ranging from low value geo-textiles to high value carpet, apparel, composites, decorative, upholstery furnishings, and fancy non-woven for new products. Jute, with its unique versatility, rightfully deserves to be branded as the "fiber for the future". In coming decades, it is expected that a number of jute mills and mini-jute plants will be seen engaged in a big way in the production of jute and jute blended yarns, especially of finer accounts, through various routes of yarn manufacturing. The uses of jute are manifold, although the traditional use remains in packing, such as sacking, hessian and carpet backing. These light weight yarns are used in value added textile applications like upholstery, furnishing, garments and fancy bags. Jute has been cultivated in India for centuries, being predominantly a crop of eastern India.

India is the leading producer of raw jute and jute products in the world. India's sacking goods production comprises 75% of the total goods production and B twill bags, used for packaging rice and wheat, and contributes 85% of the total sacking bag production. Still there exists an increasing trend of imports of jute products due to the increase in the domestic consumption of conventional jute goods. Bangladesh is the major exporter in jute goods, with India in 2nd position. Hessian cloth and bags are the major exporting items of jute goods from India. In the overall situation, there exists a unique opportunity of the jute industry to improve the social and economic conditions of the states concerned as well as the country. Being the preferred sector in raw jute production due to suitable topographical conditions, emphasis now needs to be placed on modernization of the jute sector with a view to developing a viable and efficient jute manufacturing sector in the country.

The Jute Textiles Industry occupies an important place in the national economy. It is one of the major industries in the eastern region, particularly in West Bengal. The production process in the Jute Industry goes through a variety of activities, which include cultivation of raw jute, processing of jute fibres, spinning, weaving, bleaching, dyeing, finishing and marketing of both, the raw jute and its finished products. The Jute Industry is labour intensive and as such its labour output ratio is also high in spite of various difficulties being faced by the industry. Capacity utilization of the industry is around 75 per cent. These apart, the jute industry contributes to the export earnings to the tune of nearly Rs. 1200 crores annually

Jute can be symbolizes as a golden natural fibre with versatile application aspects ranging from low value geo textiles to high value carpet, apparel, composites, upholstery furnishings, decorative color boards, fancy non-woven for new products and many more. Due to its unique versatility and long lasting nature, jute is regarded as the Fibre for the Future. In coming era, variety of mini jute plants and jute mills will be seen engaged in the production of jute and jute blended yarns.

India's production of jute always falls short of her requirements and it is imported to feed our jute mills. Bangladesh is the chief supplier of jute to India.

India is the leading jute goods-producing country globally, accounting for about 75% of estimated world production. Most of the Jute is consumed domestically due to its vast domestic market demand, with an average domestic consumption of 90% of total production.

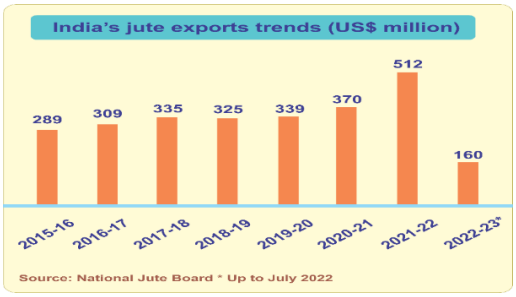


Fig. 3.6: Jute export chart

Fig. 3.7: Plastic pushback

With a shift towards sustainability and rising environmental concerns, jute products especially bags and packaging are much in demand.
Undeterred by all adversities and countless problems, the raw jute manufacturing in India has continued to go up and so has its demand due to excessive production in the jute industry.
The use of jute is increasing and it has a huge demand in the export market. The demand of jute products can be seen in industry as well as across the handloom and handicraft sector.

Employment opportunities in Jute Industry:

Gunny bags, hessian, ropes, strings, carpets, rugs, clothing, tarpaulins, upholstery, and decorative items are just a few examples of the many useful things made from jute. After undergoing a softening process, jute fiber is now also used to create men's shirting fabrics, women's sarees, and salwar-kameez materials. Thus, the industry is multi-faceted and generates huge employment.
Starting from farming of jute to trading of raw jute. It offers jobs in following areas:

- Farming
- Trading of Raw Jute
- Jute Mills and Industries
- Jute Products such as bags, gunny bags, sacking
- Jute Handicrafts

Thus, a person having knowledge of Jute Industry can work as:

- Stockists and Wholesale Suppliers of Jute Products
- Retailer of Jute Products
- Designer of Jute Products
- Artisan of Jute Handicrafts
- Trainer for developing Jute Handicrafts

Activities

Activity 1: Prepare a PowerPoint presentation or a chart on unique features and job opportunities in Jute Sector.

Materials Required:

1) Chart paper
2) Pen, pencil, coloured pens and markers
3) Eraser, sharpener
4) Scale

Procedure:

1) Collect required information.
2) Organize the collected information in PPT or chart whichever is feasible to you.
3) Decorate it with pictures and graphics.
4) Get it corrected by your teacher.

Discuss and present in the class.

Check Your Progress

Fill in the Blanks

1. Jute is called a _____ fiber.
2. The first Jute Mill was established in India in _____.
3. A _____ is a device on which fabric is woven.
4. Jute is a/an_____ fiber.

True Or False

1. The manufacturing process of handicrafts is very quick and easy. (True or False)
2. The handicraft and handloom products are made of natural and local material. (True or False)
3. It was in 1955 that the first Jute Mill was established in India. (True or False)
4. India is one of the leading jute goods-producing countries of the world. (True or False)

Question Answers

Answer the given questions briefly: (40-50 words)

1. What are handicrafts? Give two examples.
3. What is meant by the word handloom? Give two examples of handloom products.
1. What are the traditional uses of Jute fiber?

Answer the given question in detail: (100-120 words)

1. Why is the handloom and handicraft industry important?
2. Write a short note on Indian Jute Industry
3. What are the advantages of Jute products over synthetic products?

Session 2: Analyze and Describe Scope of Jute Industry

Scope of jute industry

There is a growing concern for the environment and sustainability since the past few decades. Rapid industrialization, globalization and fast fashion have resulted in pollution, large-scale migration, unbalanced and unequal development. Thus the world is increasingly moving towards natural and sustainable alternatives in all spheres of life.

Global consumers are increasingly becoming more conscious of their choices and are opting for environment friendly products. Thus there is a lot of scope for jute to replace unsustainable packaging and lifestyle products. Also increasing disposable incomes have resulted in demand of niche products such as souvenirs, gifts, home decor products and utility items such as shopping bags, gift boxes and bags, rugs and mats, soft furnishings, lamps and lighting to name a few. Thus jute industry can play a very vital role in fulfilling the demands of new age, global customers who are not only aware but have the disposable incomes to support their choices.

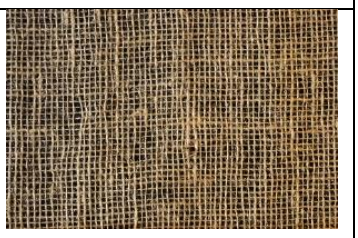
Even the fashion industry is now switching to sustainable production and consumption. As per numerous reports Indian consumers are increasingly realizing the advantages and beauty of handlooms and handicrafts.

India being one of the largest jute producer's countries can reap huge benefits of this opportunity. The Indian jute plants and mills produce a variety of products ranging from yarns, ropes and twines, sacks and gunny bags. In fact, the jute industry in India is transforming thanks to government interventions and policies, increasing demand from both international and domestic markets and sustainability concerns. Thus it is no longer limited to making sacks, gunny bags and traditional hessian fabrics. It is now producing high fashion blended jute fabrics and is also involved in the production of technical textiles, geotextiles, medical textiles etc.

1. Different types of jute products manufacturing in India and their exports:

As per government reports of 2014-15, India is one of the world's top producers of jute products and manufactures about 70% of the total jute products. The majority of the manufactured jute products are sold in the domestic market for packaging purposes. Out of the total production of Jute goods, 90 % is consumed in the domestic market (within India) itself. Following goods are majorly produced from jute in India:

Ropes and twines	

Jute yarns	
Hessian Fabric	
Carpet Backing	
Bags for packaging to be utilized in agro industries, wire and cable industries	
Geotextiles- As base cloth in construction industry	
Hi fashion blended jute fabrics	
Jute bags	
Jute Handicrafts and souvenirs	

2. Jute Products Diversification for Technical Textiles: Technical Textiles:

The ministry of textiles under the Indian Government has identified the technical textiles as the sunrise industry. Though it's in nascent stage in India but Government has introduced many schemes for the technical textile sector. These are chiefly manufactured for their performance characteristics rather than their decorative characteristics. The conventional textiles and fabrics are used for clothing and ornamentation but technical textiles are used for their functional qualities and they are produced in a manner to have enhanced strength, absorbency, durability, moisture management, chemical resistance and so on and other specialized qualities to meet the specific needs of diverse industries and sectors. There are many types of technical textiles and they are used in agricultural industry, packaging industry, medical sector, construction industry, protective textiles, industrial textiles to name a few.

Owing to its unique physical and chemical properties along with its biodegradable nature, Jute is increasingly being used in technical textiles. Its use in technical textiles such as agro textiles for crop protection, construction textiles such as geotextiles and industrial textiles such as filters and sound proofing has increased. The government has come up with many incentives and schemes for production of Jute technical textiles.

In the dynamic landscape of textile innovation, the Indian Government, through the Ministry of Textiles, has set its sights on technical textiles as the sunrise industry. While in its early stages in India, this sector has garnered significant attention, prompting the introduction of government schemes aimed at fostering its growth and development.

Understanding Technical Textiles: Technical textiles differ from conventional textiles primarily in their purpose and characteristics. Unlike textiles primarily used for clothing and ornamentation, technical textiles are engineered for their functional attributes. These textiles are crafted to exhibit enhanced strength, absorbency, durability, moisture management, chemical resistance, and other specialized qualities. Their applications span various industries, including agriculture, packaging, medicine, construction, and protective and industrial sectors.

Government Initiatives and Schemes: Recognizing the potential and importance of technical textiles, the Indian Government has implemented several initiatives and schemes to propel the growth of this sector. These schemes aim to facilitate research, development, and production of technical textiles, fostering innovation and sustainability in line with global standards.

Jute's Unique Position in Technical Textiles: Jute, distinguished by its unique physical and chemical properties, coupled with its biodegradability, has emerged as a key player in the realm of technical textiles. The integration of jute into technical textiles signifies a sustainable and eco-friendly approach to meeting the specific needs of diverse industries.

Applications of Jute in Technical Textiles: The versatile nature of jute finds expression in various technical textile applications. In agro textiles, jute is employed for crop protection, showcasing its role in sustainable agriculture practices. In construction textiles, jute-based geotextiles contribute to soil stabilization and erosion control, highlighting its significance in infrastructure development. Furthermore, jute finds its place in industrial textiles, where it is utilized for creating filters and soundproofing materials, showcasing its adaptability to diverse industrial needs.

Government Incentives for Jute Technical Textiles: To bolster the integration of jute into technical textiles, the government has rolled out incentives and schemes specifically targeted at the production and development of jute-based technical textiles. These initiatives aim to not only harness the unique properties of jute but also promote sustainable practices within the technical textile industry.

In essence, the convergence of government support, technological innovation, and the eco-friendly attributes of jute positions it as a pivotal component in the dynamic and evolving landscape of technical textiles, contributing to India's journey towards a sustainable and resilient future.

3. Challenges and limitations faced by jute industry in India

India is the one of the largest producers as well as consumer of jute. Despite this several challenges are posing a threat to the Indian jute industry.

1. Shortage of Raw Material: Despite being the largest producer India is not self-sufficient in the supply of raw material. The domestic consumption is so high that the raw material is imported from Bangladesh, Brazil, and Philippines to meet the growing need of the industry The demand for jute in India is very high because it is used for so many things like bags, clothes, and more. But the problem is, we can't grow jute fast enough to keep up with the demand.

1. **Unavailability of Quality Jute seeds:** The Indian jute industry faces a significant challenge due to the shortage of quality jute seeds. This scarcity hampers optimal industry growth by limiting the cultivation of jute with desirable traits. Quality jute seeds are crucial for robust plant growth, disease resistance, and fiber strength. Addressing this challenge requires research, innovation, and collaboration to ensure a sustainable and consistent supply of superior seeds, promoting the resilience and success of the Indian jute industry. This is another issue which is posing limitation to the Indian jute industry.

2. **Labour Shortage**: The persistent issue of labor shortage in the Indian jute industry stems from the strenuous and manual nature of the work involved. The demanding tasks, often characterized by physical exertion, drive a shift in the workforce towards alternative industries offering less labor-intensive opportunities. This transition poses a considerable challenge as it not only impacts the continuity of skilled labor in the jute sector but also underscores the need for strategic measures, possibly involving technological

advancements, to enhance productivity and attract a stable workforce. Addressing this challenge necessitates a comprehensive approach that balances the preservation of traditional labor practices with innovative solutions to ensure the sustainability of the jute industry's human resource base. Due to the laborious and manual nature of work, increasingly the people involved in various jute industries are moving to other industries.

3. **The small size of Jute making firms:** The jute production landscape in India encounters a significant hurdle attributed to the modest scale of jute manufacturing enterprises. Operating within the unorganized sector, these firms exhibit a comparatively diminutive size, rendering them insufficient to meet the burgeoning demands of the market. This inherent limitation poses multifaceted challenges, including constrained production capacities, logistical inefficiencies, and potential difficulties in adopting modern technologies. The small-scale nature of these jute making firms not only impedes their individual growth but also contributes to broader challenges in sustaining a robust and adequately supplied jute industry. Addressing this issue mandates strategic interventions such as capacity-building initiatives, infrastructural support, and collaborative efforts to enhance the overall efficiency and competitiveness of these enterprises within the jute sector. Jute production comes under unorganized sector in India and firm size is relatively very small to fulfill all the demand supply.

4. **The use of obsolete machinery and technology:** A formidable challenge confronting the Indian jute industry resides in the persistent reliance on antiquated machinery and outdated processing methods, despite notable technological advancements. This predicament engenders several repercussions, foremost among them being the compromised quality of jute products. The utilization of obsolete machinery not only hampers the precision and efficiency of production processes but also extends to time-related inefficiencies, impeding the industry's ability to meet demand in a timely manner. The reluctance or inability to embrace contemporary technological solutions further exacerbates these challenges, perpetuating a cycle of suboptimal production practices. To surmount this obstacle, strategic initiatives encompassing technological modernization, skill development, and industry-wide adoption of state-of-the-art machinery become imperative. Such endeavors are instrumental in elevating the jute industry's competitiveness, improving product quality, and aligning it with contemporary standards of efficiency and sustainability. Despite technological developments the jute industry is still using outdated machinery and methods of processing jute. This not only results in poor quality products but is more time consuming also.

Activities

Activity 1: Prepare a PowerPoint presentation or a chart on discussing different types of jute products manufactured in India

Materials Required:

1) Chart paper
2) Pen, pencil, coloured pens and markers
3) Eraser, sharpener
4) Scale

Procedure:

1) Collect required information.
2) Organize the collected information in PPT or chart whichever is feasible to you.
3) Decorate it with pictures and graphics.
4) Get it corrected by your teacher.

Discuss and present in the class.

Check Your Progress

Fill in the Blanks

1. Geotextiles are a category of _____ _____.
2. The domestic consumption of jute is so high that the raw material is imported from _____ and _____.
3. Despite being the largest producer, India _____ raw material for the jute industry.
4. Technical textiles are crafted for their functional attributes, including enhanced _____, absorbency, and durability.
5. The Indian Government has implemented initiatives to promote the production of jute-based technical textiles, focusing on _____and sustainability.

True Or False

1. India is the largest producer as well as consumer of Jute. ((True or False)

2. Out of the total production of Jute goods, only 20 % is consumed in the domestic market (within India). (True or False)
3. Jute cannot be used for manufacturing technical textiles. (True or False)
4. Technical textiles are primarily manufactured for their decorative characteristics. (True or False)
5. The jute industry in India is still limited to traditional products like sacks and gunny bags. (True or False)

Question Answers

Answer the given questions briefly: (40-50 words)

1. What are technical textiles? Give two examples.
2. How are technical textiles different from conventional fabrics?
3. What are the traditional products made by using Jute fiber?

Answer the given question in detail: (100-120 words)

1. Describe various challenges and problems faced by Indian jute industry. Why is the handloom and handicraft industry important?
2. Write a short note on scope and future prospects of jute industry.
3. What are some of the reasons for which consumers are shifting towards natural fibers and fabrics such as Jute?

Session 3: Identify Jute Market, Consumers and Governing Bodies

1. Diversified jute products and their market

Traditionally jute has been used for making hessian or burlap fabrics, sacking, food grade jute cloth bags, yarns, ropes and twines and carpet backing.
Jute fibre has a number of attractive qualities, including outstanding mechanical properties, a high capacity for absorbing and storing moisture, and the ability to biodegrade. It is also inexpensive and widely available in India. These elements make jute an incredibly excellent raw material for a variety of emerging technical textile applications in addition to its traditional uses. However, jute industry in India has predominantly manufactured ropes and twines, packaging bags and carpet backing. This has had a detrimental effect on the diversification and modernization of the jute Industry in India. With the passage of time jute has proven its versatility with a range of unique physical properties. This has opened up many new avenues for its diversification. The government has also initiated the diversification in jute industry owing to the vast scope and potential of Jute Industry in the economy. In recent years, the government has promoted the use of jute for diversified products and geotextiles other than the traditional products.

Diversified Jute Products:

Thus in recent years a range of diversified jute products have entered the market. These include:

Jute Blankets	
Decorative Jute Fabrics for cushion covers, curtains, bedsheets	
Floor Coverings	

Hand and Shopping Bags	
Handicrafts, Gifts and Other Novelty Items	

Jute Geotextiles: Geotextiles are synthetic or natural textile materials used in civil engineering applications. These are used to improve soil stability, drainage, filtration, and erosion control. They are also used in road construction and roofing material. The Indian government has also promoted the use of jute in geotextiles. Thus jute geotextiles are increasingly being used in soil erosion control, road pavement construction, protection of river banks and other civil engineering applications.

2. Jute product market Domestic and International:

The importance of jute is increasing day by day owing to emphasis on sustainability in the fashion and textile industry. It enjoys considerable demand in both domestic as well as export markets.

International Jute Product Market and Jute Exports: Over time, jute and jute products from India have seen tremendous increase in exports. The overall amount of jute exports increased at a CAGR of 9% between 2015–16 and 2020–21. As per the reports, India exported jute and floor coverings worth a combined total of nearly US$ 49 million during February-March 2022. Several other jute-based goods like gift items, ornamental fabrics, hand and shopping bags, etc. are also exported from India. The Jute Diversified Products (JDP) have the largest market share among the total shipped jute products, with exports valued at roughly US$ 169 million in 2021–22.

As per the Indian Jute Mills Association (IJMA) statistics, Sacking and Hessian exports were valued at US$ 65 million (Rs. 502.62 crore) and US$ 47 million (Rs. 363.45 crore) in 2021-22, growing from US$ 56 million (Rs. 428.98 crore) and US$ 35 million (Rs. 267.11 crore) of exports recorded in the previous year, respectively. Among the other key jute products exported, yarn exports were valued at US$ 54 million (Rs. 416.70 crore), recording a growth of 23.1% over the previous year. Exports of raw jute were valued at US$ 58 million (Rs. 449.40 crore), significantly higher than US$ 23 million (Rs. 177.43 crore) in the previous year (2021).

Domestic Jute Product Market and Demand: Most of the jute and jute goods produced in India are consumed in the domestic market. The demand from the domestic market is huge and around 90 % of jute produced in the country is utilized for domestic consumption. A majority of this consumption includes gunny bags and sacks for packaging, geotextiles applications of jute as well as handicrafts and souvenirs made of jute.

3. Government initiatives to support jute industry:

Owing to the importance of the Jute industry in the Indian economy the Indian government has launched many welfare programmes and schemes for the modernization of the jute industry as well as for the welfare of the lakhs of farmers, artisans and other people employed in the Indian jute Industry. The National Jute Board, a Statutory Body established for the growth and promotion of the jute sector, is largely responsible for implementation of the programmes for the jute industry's promotion. The board conducts research and also engages in human resource development programmes in order to explore innovative uses of jute. The main idea behind this research and initiative of the jute board is to enable both the organized as well as the decentralized sector to compete in the global market and increase the global share of Indian jute goods consumption. Let's take a look at the various initiatives and policies for the jute sector:

The Board intends to carry out initiatives that promote the development of the jute sector in order to strengthen its position. Apart from promoting Indian Jute in the international market, other key areas include the dissemination of newer technologies, machinery support, human resource development through training and design contributions, extending scholastic incentives, and addressing various health-related difficulties.

1. **Jute - Improved Cultivation and Retting Exercises (ICARE):** The program's goal is to provide suitable pre- and post-harvesting operations to small and marginal jute growers so they may produce high-quality jute and fetch a higher price for it. The Jute I-Care programme will also inform the growers on the most recent technological advancements in the nation.
2. **Jute Diversification Scheme:** This scheme is aimed at enabling the jute industry to diversify their production and manufacture products other than the traditional packaging and ropes etc. A number of initiatives would be taken up under the jute diversification scheme. Its main components are as follows:

2.1 Jute Resource Cum Production Centre: JRCPC will be established in local clusters and communities around the nation in partnership with bonafide agencies that have the necessary infrastructure for training cum-production as well as experience in skill-building programmes.

2.2 Jute Raw Material Bank: JRMB will be established in local clusters across the nation in partnership with genuine agencies that have the necessary infrastructure for storage, exhibition and sale of jute products. These agencies should also possess sufficient experience in related fields. The JRMB will purchase the raw materials at reasonable prices directly from the jute mills and raw material producers. These JRMB will also offer backward linkages to self help groups, Micro & Small Units producing jute diversified goods, Jute Artisans, and JRCPC beneficiaries. Thus it

will assist in providing jute raw material in their area to produce Jute Diversified Products.

2.3. Jute Retail Outlet: The JRO will be set up across various locations in the country for buying and selling of jute products. Like JCPRC AND JRMB these the jute retail outlets will also be opened in collaboration with bonafide agencies having requisite experience in sales and marketing of similar products and who also have the adequate infrastructure facilities required for the storage, display and selling of jute products. The JRO will give priority to women and purchase the JDPs from Jute Artisans, self help groups, Jute Micro & Small Units and beneficiaries of JRCPC (mostly women) etc.

2.4. Jute Design Resource Centre: The JDRC would be responsible for development of new and innovative designs of jute products governed by market demand with the help of experienced designers and master trainers. These designs would be shared with jute artisans, self help groups, exporters to help them get business orders for Jute Diversified Products through workshops and design development programmes.

2.5. Production Linked Incentive Scheme: The Ministry of Textiles, Government of India, has approved the Jute Product Diversification Scheme (JPDS), which is being carried out by the National Jute Board (NJB), a statutory body under the Ministry of Textiles, Government of India. During the 15th Finance Commission (2021-26), the Scheme would be in operation under the National Jute Development Programme (NJDP) Umbrella Scheme of NJB.

3. Market Development & Promotion

This scheme has been launched with a view to develop and promote markets for jute as well as jute diversified products in domestic and international markets. It will provide complete solutions for designing, branding, marketing of jute goods as well as increasing its production and generating sustainable livelihoods through jute industry. This scheme will have activities for domestic as well as international market promotion. One of the key features of this scheme is The "Indian Jute Mark". The Indian Jute mark will provide a collective identity to the Jute products and will serve as an assurance for the buyers/consumers that the product being purchased is authentic and made genuinely of Jute.

Fig. 3.8: National Jute Board

4. Scholarship Scheme for Girl Children of Workers of Jute Mills / MSME JDP Units

This scheme was started to solve the increasing labour shortage in the jute industry. It is aimed at encouraging workers to work in the jute industry. Thus this scheme will ensure that jute workers remain there for a longer period and will help in reducing workers' attrition rate, which is a big problem of the Industry. It involves providing financial incentives to the girl children of the workers of the Jute Mills/MSMEs, upon passing out Secondary and Higher Secondary examinations to encourage them to acquire the minimum required education for making them employable.

5. Other Important Initiatives:

5.1 Office of Jute Commissioner: The office of Jute Commissioner is a subordinate office under the Ministry of Textiles. It is a regulatory body and is responsible for implementing the Jute Packaging Materials (Compulsory Use in Packaging Commodities) Act 1987 and provisions of Jute and Jute Textiles Control Order 2000 (issued under Essential Commodities Act 1955). The Jute Commissioner monitors various activities, programmes to production, distribution for domestic consumption as well as for exports. It also looks after the development of jute as well as jute products.

5.2 National Jute Policy 2005: Government announced the National Jute Policy 2005. In a bid to provide the much needed thrust to the jute sector, the UPA government announced the National Jute Policy 2005 of India.The National Common Minimum Programme (NCMP) of the Government, recognizing the importance of jute to farmers and workers, and to the economy of jute growing states, and its special ecological importance world-wide, resolved that "the jute industry will receive a fresh impetus in all respects".

5.3 Jute Sacking Supply Management and Requisition Tool: For the purpose of purchasing jute sacking, an electronic platform called "JUTE-SMART" (Jute Sacking Supply Management and Requisition Tool) was put into place on November 1st, 2016. It has become operational and has shown positive developments so far.

Conclusion:

India is the leading producer of raw jute and jute products, and West Bengal is the largest producer of raw jute, covering 69.7% of the area of the total jute cultivation land in India. Thus the jute industry has become an important contributor to the economy of West Bengal as well as India. In India, the import of jute products increases commensurately with the increase in domestic consumption. World Jute exports is showing an increasing trend and India as an exporter of Jute products occupies 2nd position after Bangladesh. Hessian cloth & bags are the leading export items.

Activities

Activity 1: Prepare a PowerPoint presentation or a chart on discussing diversification of Jute products manufactured in India

Materials Required:

5) Chart paper
6) Pen, pencil, coloured pens and markers
7) Eraser, sharpener
8) Scale

Procedure:

5) Collect required information.
6) Organize the collected information in PPT or chart whichever is feasible to you.
7) Decorate it with pictures and graphics.
8) Get it corrected by your teacher.

Discuss and present in the class.

Check Your Progress

Fill in the Blanks

1. Government announced the National Jute Policy in _____.
2. _____ is the largest producer of raw jute in India.
3. The full form of ICARE is _____.

True Or False

1. Traditionally jute has been used for making sarees. (True or False)
2. Geotextiles are textiles applied in the medical equipment industry. (True or False)
3. Jute is a very expensive fiber. (True or False)

Question Answers

Answer the given questions briefly: (40-50 words)

1. Write briefly about the Jute retail outlet scheme of the Indian Government.

2. Draw the Indian Jute Mark and describe it briefly.
3. What are diversified jute products and how are they different from traditional jute products?

Answer the given question in detail: (100-120 words)

1. Describe Jute Geotextiles.
2. What do you know about the Office of the Jute Commissioner? What are its activities?
3. Name any 5 welfare schemes or programmes introduced by the Indian Government for Jute industry and describe any one in detail?

Module 4:	Role and Responsibilities of Jute Products Artisan

Module Overview

An artisan is a skilled craftsperson or worker who creates handmade or traditionally crafted items. Artisans typically specialize in a specific trade or craft, such as pottery, woodworking, jewelry making, blacksmithing, weaving, or glassblowing, among many others. They often possess a high level of expertise and knowledge in their chosen craft, and their work is known for its quality, attention to detail, and artistic expression. Artisans usually employ traditional techniques and tools, sometimes passed down through generations, to create unique and often one-of-a-kind pieces. They may work independently or as part of a collective or cooperative, and their creations can range from functional objects to decorative pieces or works of art. In recent years, there has been a growing appreciation for artisanal goods, as they often embody a sense of craftsmanship, authenticity, and cultural heritage. Many people value the skill, care, and uniqueness that come with artisan-made products.

Learning Outcomes

After completing this module, you will be able to:

- Explain roles and responsibilities of Jute Products Artisan
- Demonstrate various tools and equipment used in Jute Industry
- Explain production process of jute products with reference to handicrafts industry
- Explain jute product development

Module Structure

Session-1:	Explain roles and responsibilities of Jute Products Artisan
Session-2:	Demonstrate various tools and equipment used in Jute Industry
Session-3:	Explain production process of jute products with reference to handicrafts industry
Session-4:	Explain jute product development

Session 1: Explain Roles and Responsibilities of Jute Products Artisan

As a jute products artisan, your main responsibilities involve working with jute fibers to create a variety of handmade products. This includes tasks such as sourcing and preparing jute materials, designing patterns and motifs, weaving or handcrafting jute using traditional techniques, assembling the finished products, maintaining quality control, promoting sustainability, and engaging in marketing and sales efforts. The craftsmanship and creativity of artisan is important, for transforming jute into unique and eco-friendly items, showcasing the skill, attention to detail, and commitment to producing high-quality artisanal goods.

Attributes of Jute Product Artisan

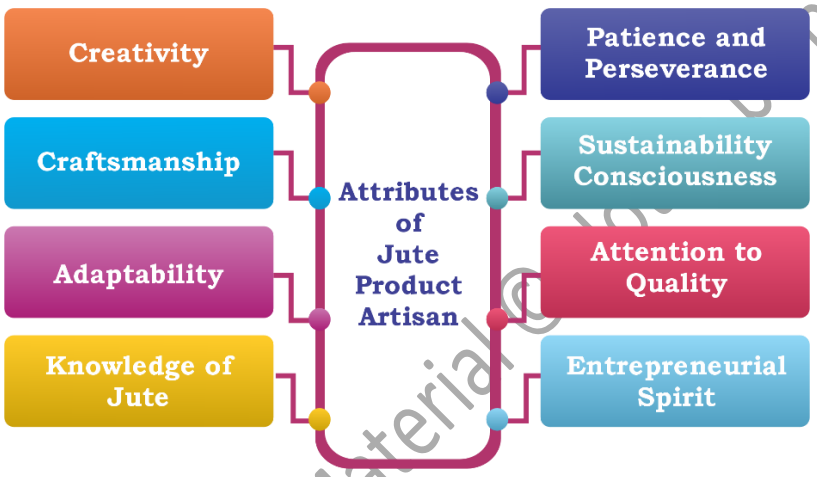


Fig 4.1: Attributes of Jute Product Artisan chart

Jute product artisans should possess certain set of attributes that contribute to their craftsmanship and expertise. The following are some notable attributes of jute product artisans:

I. **Creativity**: Jute product artisan should exhibit a high degree of creativity. They have the ability to conceptualize and design innovative patterns, motifs, and product forms using jute fibers. Their creative vision should allows them to transform jute into aesthetically pleasing and functional products.

II. **Craftsmanship**: Artisans working with jute demonstrate exceptional craftsmanship. They should possess the necessary skills and techniques to handle jute fibers, and execute intricate handcrafted methods. Their attention to detail and precision in their work contribute to the overall quality of the jute products they create.

III. **Adaptability**: Jute product artisans should be adaptable and versatile. They should be skilled in various techniques such as weaving, knotting, braiding,

and macramé, allowing them to explore different styles and create diverse jute products. They can adapt their craft to suit different design requirements and customer preferences.

IV. **Knowledge of Jute**: Artisans working with jute should possess in-depth knowledge about the characteristics, properties, and potential applications of jute fibers. They understand how to best utilize jute's natural strength, durability, and eco-friendly attributes in their creations. This knowledge should enable them to make informed decisions during the material selection and design stages.

V. **Patience and Perseverance**: Jute product artisans often engage in time-consuming and labour-intensive processes. They demonstrate patience and perseverance, as weaving or handcrafting jute products can require meticulous effort and a significant amount of time. Their commitment to their craft should ensures the production of high-quality, intricately crafted jute items.

VI. **Sustainability Consciousness**: Jute artisans should be able to prioritize sustainability and environmental consciousness in their work. They should be able to understand the eco-friendly nature of jute fibers and strive to incorporate sustainable practices into their production processes. This includes using natural dyes, minimizing waste, and promoting the use of biodegradable materials.

VII. **Attention to Quality**: Jute product artisans have a keen eye for quality. They should meticulously inspect their work at each stage of the production process, ensuring that the finished products meet the desired standards of craftsmanship and durability. Their commitment to quality should contribute to the reputation of jute products as durable and reliable.

VIII. **Entrepreneurial Spirit**: Some jute product artisans possess entrepreneurial skills, allowing them to market and sell their creations independently. They should understand the importance of branding, pricing, and engaging with potential customers to promote their jute products effectively. Overall, jute product artisans should combine creativity, craftsmanship, adaptability, and sustainability consciousness in their work. They should leverage their knowledge of jute fibers and apply their skills to create unique, high-quality, and eco-friendly jute products that showcase their artistic vision and dedication to their craft.

Role and responsibilities of a jute products artisan

As a jute products artisan, the role is centered around working with jute, a versatile natural fiber derived from the jute plant. Jute is commonly used to create a wide

range of products, including bags, rugs, wall hangings, footwear, home decor items, and more. The following are key responsibilities of a jute products artisan:

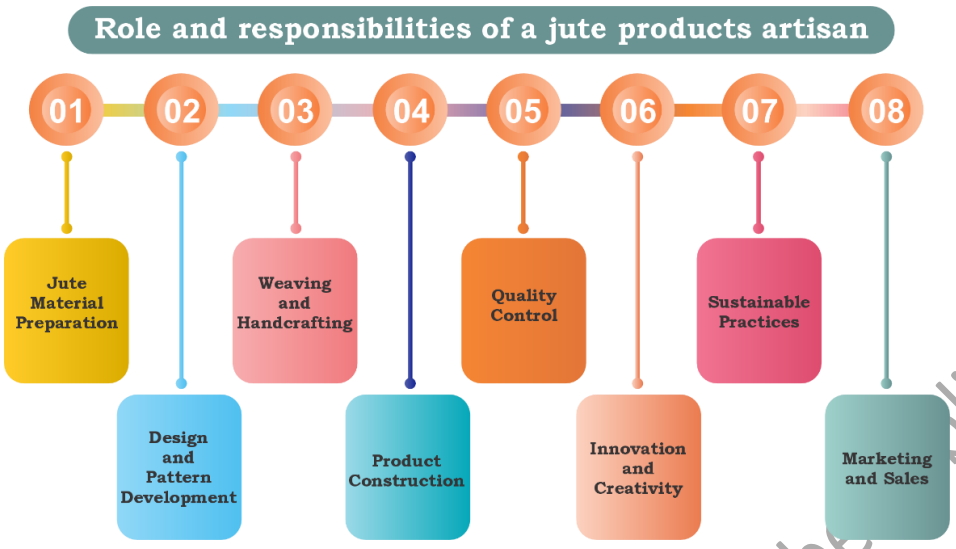


Fig 4.2: Role & responsibilities of jute products artisan chart

I. **Jute Material Preparation**: The responsibilities may include sourcing high-quality jute fibers, cleaning and preparing them for further processing. This may involve sorting, stripping, and cleaning the jute fibers to ensure they are ready for weaving or other techniques.

II. **Design and Pattern Development**: The artisan may be involved in designing jute products or collaborating with designers to create unique patterns and motifs. This could include sketching designs, selecting colors, and determining the layout for the final product.

III. **Weaving and Handcrafting**: Jute artisans often specialize in weaving techniques to create jute products. This involves using traditional looms or hand-weaving methods to interlace the jute fibers and create the desired texture and pattern. Handcrafting techniques such as knotting, braiding, or macramé may also be employed to add decorative elements to the jute products.

IV. **Product Construction**: Once the weaving or handcrafting is complete, artisans assemble the jute pieces into finished products. This may involve stitching, sewing, or attaching additional components such as handles, zippers, or closures.

V. **Quality Control**: A jute products artisan, is responsible for maintaining high standards of quality in their work. This involves inspecting the finished products for any defects, ensuring that they meet the desired specifications, and making any necessary adjustments or repairs.

VI. **Innovation and Creativity**: Jute artisans often strive to bring innovation and creativity to their work. They may experiment with different techniques,

explore new designs, and incorporate other materials or embellishments to add uniqueness and artistic value to their jute products.

VII. **Sustainable Practices**: Jute is known for its eco-friendly and biodegradable properties. A jute artisan, should prioritize sustainable practices, such as using natural dyes, minimizing waste, and promoting environmentally friendly production methods.

VIII. **Marketing and Sales**: Depending on the circumstances, the artisan may also be involved in marketing and selling the jute products. This could include showcasing work at exhibitions, participating in trade fairs, establishing an online presence, or collaborating with retailers or wholesalers.

As a jute products artisan, the role combines creativity, craftsmanship, and a passion for working with natural materials. The responsibilities revolve around transforming jute fibers into beautiful and functional products while upholding quality standards and promoting sustainable practices.

Product and material handling

Product and material handling are crucial aspects of the work of jute product artisans. Here is a discussion on these topics:

Fig 4.3: Product and Material handling chart

I. **Material Sourcing:** Jute product artisans begin by sourcing high-quality jute fibers for their creations. They need to identify reputable suppliers or sources that provide jute with the desired qualities such as strength, texture, and color. They may consider factors like sustainability, organic production methods, and fair trade practices when selecting their jute materials.

II. **Material Preparation:** Once the jute fibers are acquired, artisans engage in material preparation. This involves cleaning and treating the jute to ensure it is free from impurities and ready for further processing. It may include activities such as sorting, stripping, washing, and drying the jute fibers.

III. **Material Storage:** Proper storage of jute materials is essential to maintain their quality and longevity. Jute product artisans store their jute fibers in a clean and dry environment, protecting them from moisture, pests, and excessive exposure to sunlight. They may use containers, bags, or racks specifically designed for jute storage.

IV. **Design and Pattern Development:** Jute product artisans spend time designing patterns, motifs, and product forms. They may sketch their ideas, experiment with color combinations, and create prototypes before starting the actual production. Design development may involve integrating other materials, embellishments, or incorporating traditional and contemporary elements into their jute products.

V. **Workstation Setup:** Jute product artisans organize their workstations to facilitate efficient production. They arrange their tools, equipment, and materials in a systematic and accessible manner. This setup allows them to work smoothly and minimizes the risk of accidents or damage to the jute fibers.

VI. **Production Techniques:** Jute artisans employ various production techniques based on the desired product. This can include weaving on traditional looms, hand-knotting, braiding, or macramé. They skillfully handle the jute fibers, paying attention to tension, alignment, and consistency throughout the production process.

VII. **Quality Control:** Throughout the production stages, jute product artisans implement quality control measures. They inspect the jute products for any defects, irregularities, or inconsistencies. This includes checking for weaving errors, loose threads, or any imperfections that may affect the overall quality. Artisans may make necessary adjustments or repairs to ensure the final product meets their standards.

VIII. **Packaging and Storage of Finished Products:** Once the jute products are completed, artisans carefully package and store them to maintain their quality until they are sold or shipped. Proper packaging protects the products from dirt, moisture, and damage during transportation or storage. It may involve using eco-friendly packaging materials and considering appropriate labeling for branding and product information.

Product and material handling are integral parts of a jute product artisan's work. From sourcing and preparing jute fibers to designing, crafting, and packaging the final products, artisans pay careful attention to every step of the process. By ensuring proper handling and quality control, they create jute products that meet customer expectations and uphold their artistic vision.

Activities

Visit a jute industry/cluster and enlist the roles and responsibilities of a jute product artisan.

Materials Required:

1. Notebook
2. Pen
3. Camera for visual documentation
4. Vehicle (bus) for field visit

Procedure:

1. Visit the jute industry with your teacher and observe the artisans in terms of how they work observe and document the entire process followed by them along with their role and responsibilities throughout the product development stage.
2. List out your findings and observations.
3. Document your findings in form of a report.

Check Your Progress

Fill in the Blanks

1. An artisan is a _____ craftsperson.
2. A jute artisan works with _____.
3. Jute product artisans exhibit a high degree of _____.
4. Jute is known for its _____ and biodegradable properties.
5. Proper _____ of jute materials is essential to maintain their quality and longevity.

Question Answers

Short answer questions:

1. What is a jute product artisan?
2. How to do jute Material Storage?
3. Why Sustainability Consciousness is important for Jute artisans?

Long answer question:

1. Discuss Attributes of Jute Product Artisan.
2. Discuss the Role and responsibilities of a jute products artisan.
3. Discuss Product and material handling for jute artisans.

Session 2: Demonstrate Various Tools and Equipment Used in Jute Industry

Introduction

A Jute Products Artisan is responsible for producing various jute products with pre-determined specifications and as per the market demand. Production begin with measurements, drafting patterns, cutting, assembling, joining and stitching and later finishing and packing. Each of these steps requires few tools and equipment for accurate work. Knowledge of the equipment is very essential to communicate effectively in the workroom to minimize errors.

A. Measuring and marking tools

1. **Measuring tape:** A measuring tape is used to take accurate measurements for the products. The measuring tape should be flexible, high quality with smooth surface and metal tips to prevent it from unravelling or stretching. To make switching between systems easier, tape is labelled in both centimeters and inches. Typically, tapes measure 150 cm (60 inches) in length. A flexible synthetic or fiberglass tape is the greatest option because it does not stretch or break and allows for precise measurements over curved surfaces.

Fig. 4.4: Measuring tape

2. **Ruler:** A ruler is used for taking and marking straight measurements. Ruler of 15 cm to 30 cm long and yard stick of 1.5 meter scale marked in centimetres and inches are used to measure.

Fig. 4.5: Ruler

3. **L–square:** It is an L-shaped ruler used to measure perpendicular lines with a perfect right angled edge.

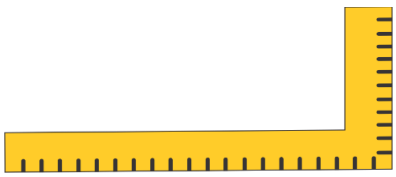


Fig. 4.6: L–square

4. **Tailor's chalk:** It is used to mark measurements, stitch lines, cutting lines, assembly points and other relevant marks on the products while manufacturing. It is an efficient marking tool which leaves no permanent marks.

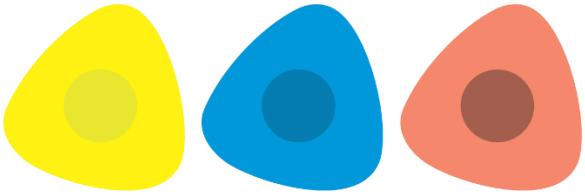


Fig. 4.7: Tailor's chalk

5. **Marking Pencils:** These are wax based pencils in pastel colours which are used to mark cutting lines, stitching lines, assembly points etc.

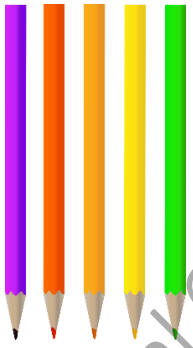


Fig. 4.8: Marking Pencils

6. **Tracing Wheel and Carbon paper:** They are used to transfer pattern lines, stitch lines, cutting lines and other markings.

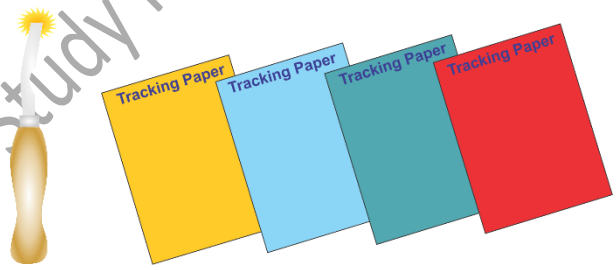


Fig. 4.9: Tracing Wheel and Carbon paper

B. CUTTING TOOLS

Shears and scissors are important for the construction of jute products and other handicrafts. Both shears and scissors use similar basic operating principles, however they have different applications. For improved grip when cutting thick or many layers of patterns, shears have one finger ring that is larger than the other. The finger rings on scissors are all the same spherical shape. Cutting the cloth and the paper design should each be done with a different set of shears or scissors.

The following types of shears and scissors that are used in construction of different products of jute:

1. Shears

i. **Dress making shear-** These are heavy duty scissors which are designed specifically with the needs of cutting heavy fabrics in mind. The handle of shear is counter balance from the blades, feasible to cut fabric against a flat surface without distortion. In shears, one of the finger rings is larger than the other. The finger rings on scissors and shears are known as "bows". The length of the blade varies from 25 to 30 cm.
The edges of shears are round with a bevelled edge and sharp. Shears are available in different materials from heavy brass to very light weight materials and are comfortable in handling.

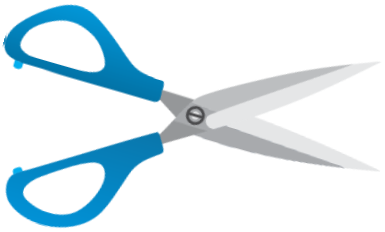


Fig. 4.10: Dress making shear

ii. **Bent-handle shears-**These shears have straight blades with a handle that is off-set at an angle allowing the lower blade to stay flat on a cutting surface. The design of the handle allows the bottom blade to rest on the flat surface below the fabric without lifting the fabric from the flat surface. The blade size is less than 15 cm long.

Fig. 4.11: Bent-handle shears

iii. **Electric shears-** It is a type of hand tool suitable for a variety of cutting applications. They are powered shears. Most varieties are powered by alkaline batteries or rechargeable batteries.

Fig. 4.12: Electric shears

iv. **Pinking shear**-These shears have saw tooth blades. Hence they produce a notched cutting edge (zig zag) which gives a neat appearance to the raw edges in the inside of the product. It automatically notches and reduces bulk in seams and creates a decorative finish. Blade length range from 7" to 10.5".

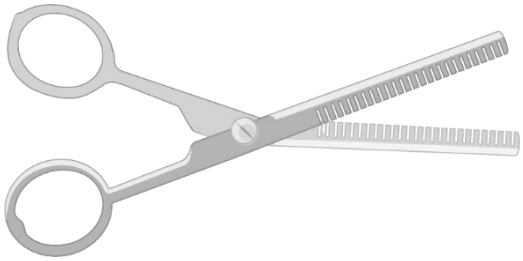


Fig. 4.13: Pinking shear

2. Scissors: Scissors are hand operated cutting tool. They are 5 to 6 inches long, used for light cutting, trimming, clipping corners, cutting curves, snipping threads and trimming seams and various thin materials, such as paper, cardboard, metal foil, thin plastic, cloth, rope and wire etc. Following types of scissors are used in construction of jute products:

i. **Embroidery Scissors-** These are light weight cutting scissors with 3 to 4 inches in size with narrow blade tapering into two sharp points. Blades are fixed by a pin, screw or rivet and designed with two evenly sized ring handles. These scissors are ideal for clipping and notching, trimming fabric from delicate appliques, embroidery and snipping thread tails. These are used while embellishing jute for making products.

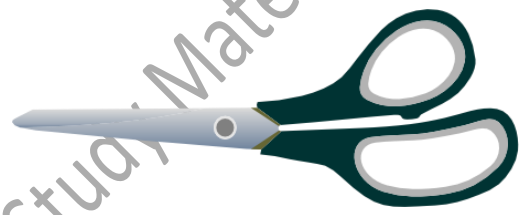


Fig. 4.14: Embroidery Scissors

ii. **Button Hole Scissors-**These scissors are adjusted to cut button holes of required length. They are greatly used when many button holes are to be made. Buttonhole scissors have a special adjustable screw for securing them partially open as per the length of buttonhole required usually between 1/2" and 1¼"that prevents cutting of the stitches at the buttonhole end. These are used in jute products such as folders and bags where buttons are used for enclosures.

iii. **Trimming Scissors-**These are used for trimming or clipping seams and cutting corners, and are generally 15 to 17.5 cm long with narrow blades and tapered sharp points.

iv. **Snipping Scissors-**These are spring-action clippers with a finger loop featuring very short blades for cutting thread tails and clipping seams.

Along with shears and scissors, a number of cutting machines are used for cutting panels for bulk production of jute products. Following are different cutting machines used in the industry:

1. **Straight knife:** A straight knife cutting machine is one of the most common cutting machines used to cut multiple plies of fabric together. As the name suggests, a straight knife cutting machine comprises of a straight knife mechanism which cuts curves accurately. This type of machine is very versatile, portable and effective.
2. **Band knife:** A band knife cutting machine is similar to a machine used for cutting wood. It works automatically according to the height of fabric plies. A band knife cutting machine cuts fabric plies more precisely as compared to a straight knife cutting machine.
3. **Round knife:** A round knife cutting machine helps in cutting more than five layers of fabric at a time. It is electrically operated having a round circular shaped blade with a guard in the front of the blade. It is generally used in small garment manufacturing units. There are several sizes and types of rotary cutters available. Smaller diameter blades make cutting out curves and details much easier; whereas the larger-diameter blades make quick work of long, straight cuts.
4. **Die cutting machine:** A die cutting machine cuts fabric lays by pressing a rigid blade through the lay of the fabric. It is used when small motifs and parts with a particular shape and pattern needs to be cut.

C. SEWING/ASSEMBLY TOOLS

For construction and assembly of jute products various tools such as needles, threads and other sewing needle are important. A variety of needles and threads are used for stitching and/or assembly of various jute products.

1. Needles

A. Hand sewing needles- A hand sewing needle is a long, slender steel shaft, with an eye at one end. The shaft tapers to a fine ball point tip or wedge end. These needles function to carry the thread through the fabric while hand sewing. Needles are designed in a range of sizes, types, and classifications developed according to specific use.

For each needle type, sizes range from a low number, (coarse needle) to higher number (finer needle). Diameter of the needle shaft increases proportionately at the eye end as per the length and size.

The factors considered for the selection of hand needles are as follows:

a. Structure of fabric

b. Weight and type of fabric

c. Type of thread

d. Size and weight of thread and

e. Intended use

The needles available for hand sewing are as follows:

i. **Ball point needle-**A ball point needle is designed with a rounded tip and is very fine, long with a small round eye, designated as medium length, sizes range from 5 to 10 for knits and lingerie fabrics. Ball point needle slides between the yarns instead of piercing as it penetrates the fabric. It reduces occurrence of holes and runs in fabrics such as jersey and tricot. Used for beadwork, sewing sequins, pearls, etc.

ii. **Crewels-**A needle is designed with a long oval eye and designated as medium length; sizes range from 1 to 12 to carry multiple strands of thread for embroidery. 1 to 10 number sizes are sharp pointed, medium – length needles with large eyes for easy threading. They are used for most standard embroidery stitches.

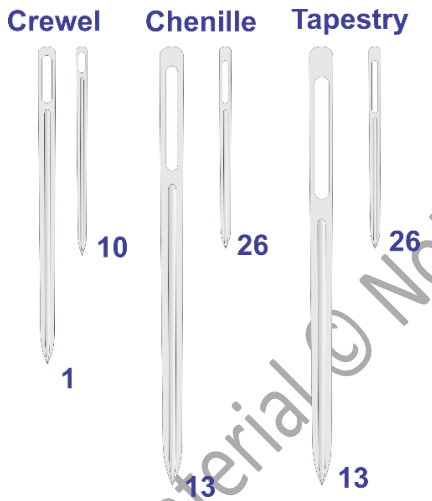


Fig. 4.15: Crewels

iii. **Chenille-**Large-eye needle with sharp point for ribbon embroidery. Chenille needle come in different sizes ranging from 13 to 26 number that are sharp pointed, thicker and longer with large eyes. They are used for embroidery work with heavier yarns.

iv. **Tapestry-**Large-eyed needle to hold multiple stands of threads with a blunt point is used for making cross stich, for sewing knitted fabrics and crochet materials.

v. **Sharps-** A needle with a small rounded eye and of medium length is called the sharp. Sizes range from 1 to 12. These are general purpose needles with sharp point for sewing and appliqué.

vi. **Darners-**A coarse needle designed with a large, long oval eye. Designated as long length, the sizes range from 14 to 18. It can carry multiple strands of thread for weaving on loosely woven woollen and open weave knit fabrics.

B. Machine sewing needles: Sewing machine needles are made up of steel, available in different sizes and types for both industrial and home sewing machines. Size varies from fine to coarse. Higher numbers indicate thicker points and coarser

needles. Needles are standardized and classified as per the model number of machine.
Majority of sewing needles are as follows:

i. **Ball-point needles:** are used for sewing knits and meshes.

ii. **Sharp-point needles:** are used for sewing fine woven fabrics.

iii. **Universal point needles:** are used for sewing both knits and woven.

iv. **Denim needles:** are used for sewing heavy, dense denim fabrics.

v. **Leather needles:** have a wedge-shaped tip for punching through leather, even for heavy vinyl and similar fabrics.

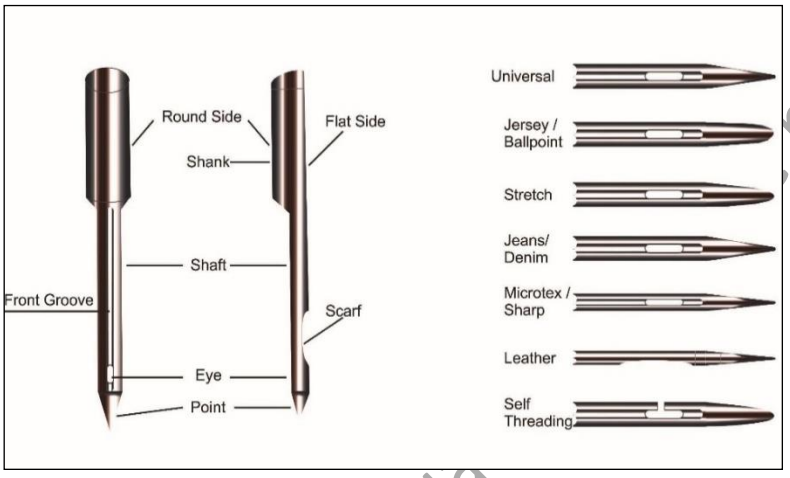


Fig. 4.16: Machine sewing needles

2. Sewing and decorative threads: Sewing and other decorative threads are an integral component of the jute product. A wide variety of threads namely, cotton, polyester, polycot and rayon are available for varied end uses. Sewing threads are used wherever the panels are stitched together in the product. While decorative threads are generally used in assembly purposes such as in jute dolls where the yarns are tied in place using these threads.

3. Glue Gun and Glue Stick: Both glue gun and glue stick are used to stick the parts and panels together while assembling jute products such as jute dolls. The glue gun is operated by electricity which heats up the flue and makes it easier to be applied on the parts for sticking. These are used to assemble parts and panels of the products where the end product does not need to be washed frequently.

Fig. 4.17: Glue Gun and Glue Stick

4. Sewing Machines: A sewing machine is used to stitch the fabric and other pliable materials together with threads. A number of sewing machines are used for different stitch formation. Single needle lock stitch machine is used majorly for basic sewing. A sewing machine uses feeding mechanisms to regulate the fabric and creates a fine stitch that joins the materials together. It has a number of parts and attachments, each with a specific purpose and function.

Domestic sewing machines and industrial sewing machines are the two primary categories of sewing machines. Industrial sewing machines are heavy motor machines used for mass production in industries. While domestic machines are used for domestic purpose.

Another way of categorizing sewing machines is to categorize them on the basis of their mode of operation that is mechanical, electrical and computerized. Mechanical machines are hand operated and run on human power. While electric and computerized machines run with electricity and motor.

Sewing machines can also be classified into different categories based on the machine bed and feed mechanism. Following are the machine beds available:

a. **Flatbed:** The most common type, resemble traditional sewing machines with the arm and needle extend to the flat base of the machine used for sewing flat pieces of fabric together.

Fig. 4.18: Flatbed

b. **Cylinder bed:** These machines have a narrow, horizontal column which allows fabric to pass around and under the column. The diameter of the cylinder-bed varies from 5 cm to 16 cm. It allows easy rotation of tubular or cylindrical pieces such as jute bags.

Fig. 4.19: Cylinder bed

c. **Post bed:** These machines include bobbins, feed dogs in a vertical column that rises above the flat base of the machine. The height of column ranges from 10 cm to 45 cm, that make access to the sewing area.

Fig. 4.20: Post bed

d. **Feed of the arm:** Material is fed along the axis of a horizontal column. The design limits the length of the seam sewn to the length of the column, used for stitching of sleeve and shoulder seams.

Fig. 4.21: Feed of the arm

Types of feed mechanisms:

The main types of feed mechanisms are as follows:

- **Drop feed**: The feed mechanism lies below the machine's sewing surface. In this mechanism the movement of fabric depends on the feed dog. The fabric moves with every stitch by the movement created by feed dog.

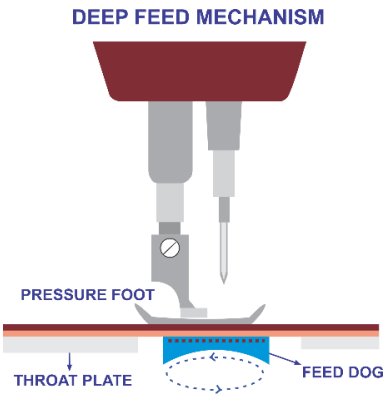


Fig. 4.22: Drop feed

- **Needle feed**: The needle itself acts as the feed mechanism, which minimizes slippage and allows one to sew multiple layers of fabric. The mechanism is useful while sewing thick fabrics. The needle after penetrating fabric layers enters the feed dog and with the movement of feed dog the needle also moves keeping the layers of fabric intact.

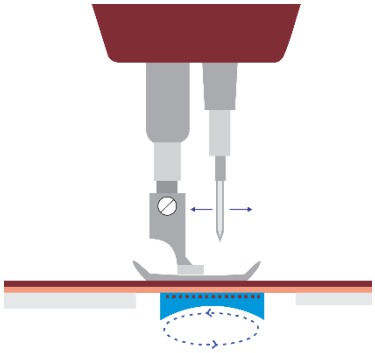


Fig. 4.23: Needle feed

- **Differential feed**: The differential feed mechanism works similar to drop feed mechanism. In such mechanism a set of two individual feed dogs are responsible for moving the fabric.

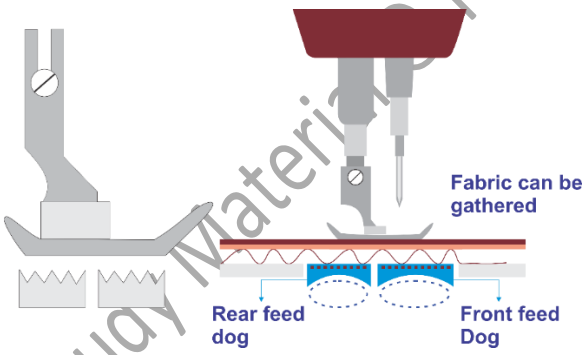


Fig. 4.24: Differential feed

- **Top feed**: In such feed mechanism two sections of presser foot are used. One section holds the fabric while the other moves the top fabric layer.

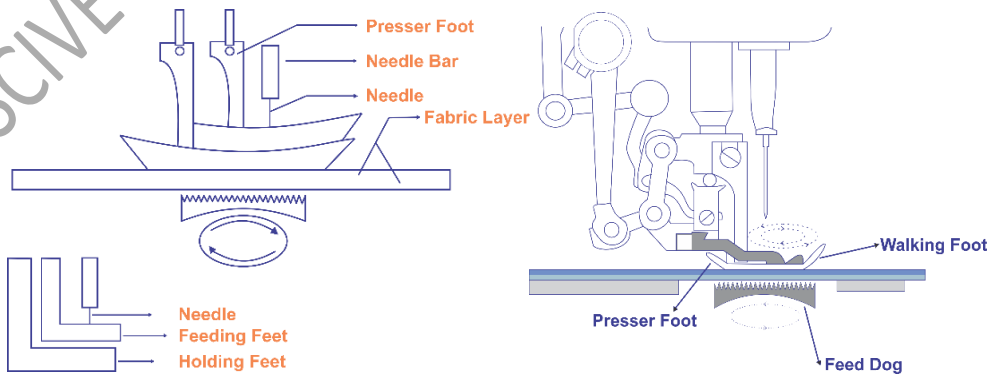


Fig. 4.25: Top feed

- **Unison feed**: It is a combination of needle feed and top feed where both needle and a two-section presser foot are responsible for the feed.

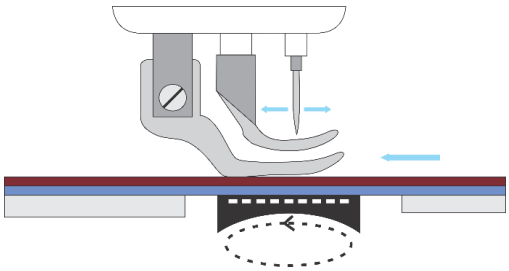


Fig. 4.26: Unison feed

- **Puller feed:** In this system a roller is used along with drop feed mechanism. This roller is placed behind the presser foot. The roller pulls the fabric after each stitch.

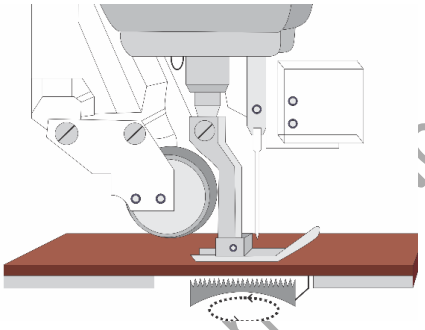


Fig. 4.27: Puller feed

Except the basic sewing machines, a number of specialized sewing machines are used for special operations such as overlock, buttonhole, bar tack etc. An overlock machine or a serger is used to finish the raw edges in stitched jute products such as jute table mats, coasters, bags, folders etc.

5. Sewing aids

i. **Ball head Pins:** They are available in different sizes for use in different fabrics for holding of fabrics together temporarily before stitching. These are long slender pins with highly polished finish and a fine tip for easy penetration into fabric without puckering it. They must be rust proof.

Fig. 4.28: Ball head Pins

ii. **Thimble:** A sewing thimble safeguard the index finger or the middle finger of the right hand while hand sewing. Helps to push needles through the material being sewn and to prevent fingers from getting pierced by the needle. It helps to protect the index finger or the middle finger while working with embroidery stitches. They are available in small (6) to large (12) sizes.

Fig. 4.29: Thimble

iii. **Seam Ripper:** A seam ripper is used to open and pick out unwanted stitches/threads. The fine tip of a seam ripper picks out single thread and cuts it.

Fig. 4.30: Seam Ripper

iv. **Needle Threader:** It is used for both hand and machine needles to push the thread through needle eye. It is available in different sizes. Helps for easier threading of both yarn and thread of different sizes.

Fig. 4.31: Needle Threader

4. General Tools

i. **Pin Cushion:** Pin cushions are useful to store needles before and after they are removed from the fabric. Some pin cushions have an emery pack for cleaning and sharpening pins and needles and some cushions can fit on the wrist for handy use.

Fig. 4.32: Pin Cushion

ii. **Awl:** It is a small, sharp-pointed tool used to punch small, round holes for marking.

Fig. 4.33: Awl

iii. **Loop Turner:** It is a long wire with a latch hook, used for turning bias strips.

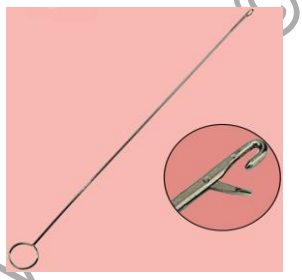


Fig. 4.34: Loop Turner

iv. **Point Turner:** This is a long wooden tool whose point can be inserted into the corners of collars, seams, etc., so as to give a neat pointed appearance.

Fig. 4.35: Point Turner

v. **Stiletto:** This is a pointed metal with a wooden handle and is used to make eyelet holes or openings.

IMPORTANCE OF TOOLS AND EQUIPMENT

The significance of the tools and equipment used in the production of jute products lies in their contribution to improving productivity, efficiency, and quality throughout the manufacturing process. Jute is a popular and adaptable natural fibre that may be used to make a variety of products, such as bags, carpets, rugs, fabrics, and more. For a number of reasons, having the proper tools and equipment is essential:

1. Productivity increases because workers can handle jute more effectively because of specialised tools and equipment that helps the production process run more smoothly. Higher output and increased productivity are the results, both of which are necessary for satisfying market needs.

2. Jute fibers, yarns and fabric may be precisely cut, shaped, and weaved with the use of high-grade tools, creating products of consistently high quality. To maintain the market reputation of jute products and to guarantee customer satisfaction, quality upkeep is essential.

3. Automating some portions of the production process using modern equipment can cut down on the requirement for manual labour and maximise resource use. Long-term cost savings and increased market competitiveness for jute products are additional potential benefits of this.

4. Manufacturers may meet a wider consumer base and market demands by experimenting with new designs and patterns and expanding their product line due to advanced machinery.

Activies

Identify and recognize the tools and equipment used by a jute products artisan at different stages of production. Prepare a flow chart for the same.

Materials Required:

1. Pen, pencil, colored pens
2. A4 size sheet/ Chart paper

Procedure:

1. Identify the tools and equipment required by a jute products artisan.
2. Categorize the tools and equipment based on their use at the different stages of production.
3. Enlist the same in form of a flow chart.

Check Your Progress

Fill in the Blanks

1. A _____ should be flexible, high quality with smooth surface and metal tips to prevent it from unravelling or stretching.
2. The finger rings on _____ are all the same spherical shape.
3. A _____ needle is designed with a rounded tip and is very fine, long with a small round eye.
4. _____ and _____ are used to stick the parts and panels together while assembling jute products such as jute dolls.
5. A sewing machine uses _____ mechanisms to regulate the fabric and creates a fine stitch that joins the materials together.

True Or False

1. Point turner is a pointed metal with a wooden handle and is used to make eyelet holes or openings. (True or False)
2. Awl is a small, sharp-pointed tool used to punch small, round holes for marking. (True or False)
3. A seam ripper is used to safeguard the fingers while stitching. (True or False)
4. Unison feed is a combination of needle feed and top feed where both needle and a two-section presser foot are responsible for the feed. (True or False)

Session 3: Explain Production Process of Jute Products with Reference to Handicrafts Industry

The handicraft industry, which employs millions of people, is a significant part of the Indian economy. India manufactures a variety of wooden, ceramic, glass, pottery, and textile products in this industry. Production of jute products is one of the important sub sectors of the handicrafts sector. The sub sector is mostly unorganized like most of the handicrafts sub sectors. But due to demand of these products automation and organized assembly lines are set in the sector to fulfill the demand.

Jute is the most versatile fibre. This golden fibre is the most produced fibre of the country after cotton. Due to its versatility, jute is used to produce a number of products including table mats, coaster, dolls, bags, folders, bottle covers, wall hangings, tea coasters, pen holders etc.
The huge variety of products can be produced with both jute yarn and fabric as the basic raw material. These products are either structured stitched products or assembled products which are put together with different techniques.

The process of production for these is similar except some addition product specific steps. Following is the general flow of production for Jute Products:

1. Designing and Market Research

Production of any products starts with an idea which is converted into a design. This idea is based on the creativity aided with the demands of the market. A Jute Products Artisan must analyze the market demand of the jute products and plan the range of products which are most demanded.

The market is analyzed based on the consumer behavior for the range of products sold in the market in the same niche. This analysis can be done through surveys, research and statistical analysis. Once, the market is analyzed, the Jute Products Artisan plans for the range of products to be designed. The artisan either designs the products himself/herself or connects with a professional designer who can help him/her in the designing.

Once the designs are finalized, the raw materials for the products are sourced and the costing of the final product is calculated. The Jute Product Artisan is involved in the sourcing and costing of materials and product. After the finalization of costing and raw material a TechPack is made for the product. A TechPack is an official document which includes each detail of the designed product including the sketch, type of embellishment, fabric, trims, ready size, stitching and finishing procedures etc. are written. It acts as the medium of communication between the departments and artisans of the industry.

For export orders, the designs can be sent by the buyer in form of TechPacks which is followed by the Artisan for the details of th product.

Fig. 4.36: Designing and Market Research

2. Pattern Making

After the TechPacks are made, the next step is to prepare paper patterns for the products; in case of stitched products and a step by step process chart for assembled products.

A patten is the blueprint of any product. The Jute Product Artisan prepares a paper pattern for the cutting and stitching of the product. Paper patterns are made with accurate measurements of the product as per the TechPack. Cutting and stitching lines are marked on the pattern for easy duplication and mass production. Patterns are made for stitched products such as table mats, coasters, jute bags, folders etc.

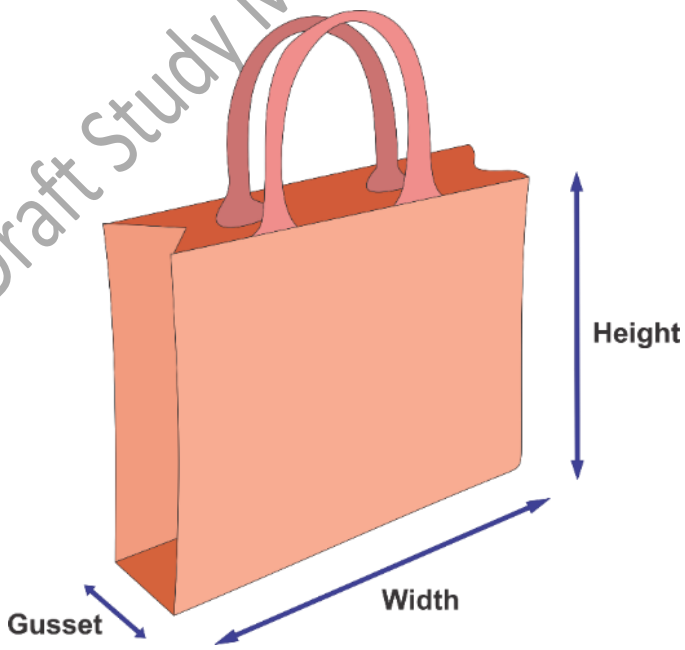


Fig. 4.37: Pattern Making

For products which are made from jute yarn as raw material, a sheet with assembling details, proportions and specifications with the construction details

is made. For example, in case of jute dolls, the assembling sheet will mention the ways to assemble jute yarns in order to make features of the doll. It will mention the places where the yarns are tied, pated or bonded together.

3. Cutting

After the patterns are made, cutting of the fabric/yarns is done as per the pattern. While cutting the pattern pieces details like seam line etc. are transferred. The cut pieces are bundled and labelled. These are then sent for stitching or assembling.

Embellishments are added on the pattern pieces before and/or after cutting depending upon the instructions in the TechPack.

4. Stitching/ Assembling

After cutting, the Artisan stitches or assembles of the pattern pieces to make the final product.
In case of stitched product following assembly systems are followed:

- **Progressive bundle system-** In this system bundles of parts and panels are moved in sequence from one artisan to another. Each artisan in line is responsible to stitch and finish one part of the product from the starting. The operators in the line, specialize in one operation, for example building of straps/handles of bags.
- **Unit production system-** In this system a single product is passed from one operator/ worker/ artisan to another after completion of operation that the operator specializes in. At the end of the cycle a single complete product is unloaded. The transfer of parts of product from one operator to another is done through a carrier.
- **Modular production system-** This system emphasizes on team method of assembly. Members of these teams are either responsible for entire product or specific operation in the assembly line.

In case of products where the construction involves assembling of different parts together, the product assembly process sheet is followed for the construction details. This can also be done in the above determined production systems in large manufacturing units.

Fig. 4.38: Stitching and assembling

In small units complete task of stitching and assembling of parts and panels is performed by one Artisan.

5. Finishing and Packing

Stitched/ assembled products are finished in the next step. Where loose thread, any stains, dirt etc. are removed. Here the products are also assessed for quality by checking the measurements, proportions, embellishments of the product.

Finished products are then packed for shipping and sale in the market.

Activies

Prepare production flow of jute products.

Materials Required:

1. Pen, pencil, colored pens
2. A4 size sheet/ Chart paper

Procedure:

1. Identify the production process of jute products.
2. Enlist the same in form of a flow chart.

Check Your Progress

Fill in the Blanks

1. Production of any products starts with an idea which is converted into a _____.
2. _____ is the first step in manufacturing of a jute product.
3. The cut pieces are bundled and_____.
4. _____production system emphasizes on team method of assembly.

Question Answers

1. Enlist the steps of production of a jute product.
2. Briefly explain designing of jute products.
3. What is a TechPack?

Session 4: Explain Jute Product Development

A table mat is are table coverings used to protect the table from dirt and stains. A coaster is used to hold and cover drinks. Both the products act as barrier between the table and food so that the table is not spoiled while it is used. These mats can be made of different textile material according to the usability and preference.

Jute is a versatile fibre which is used to produce a number of products including decorative artifacts, home furnishing and fashion accessories. Due to the strength of the fibre it is used for items such as table mats and coasters which undergo regular wear and tear. Jute mats are sturdy and don not slip on the table making them a perfect fit for the table.

Both, jute yarn and/or fabric are used as raw materials for producing table mats and coasters. When yarn is used as raw material, twisting or braiding is done to produce the products. While when raw material is fabric, jute fabric is cut and stitched for making table mats and coasters.

PRODUCTION PROCESS OF JUTE TABLE MATS AND COASTER USING YARN AS RAW MATERIAL

As any other product, production of a Jute Table mat and Coaster starts with planning and designing as per market demand and availability of resources. Once the design is finalized, TechPacks and patterns are developed based on which the products are made by the Artisan. The TechPacks specify the colours, designs and patterns of braiding and twisting yarns and other minor details which is communicated to the Artisan.

Various twisting and braiding techniques are used for making Table mats and Coasters using jute yarns. The yarns are twisted/braided, these yarns are stitched and joined together through looping/ stitching in required shape for. Different coloured yarns are used to create interesting designs while twisting and joining of yarns. Once the table mat/ coater is made extra fibers are clipped for finishing.

Fig. 4.39: Jute Products

Following are the steps for production of table mats and coasters using jute yarns:

1. Braiding of the jute fibre.

Fig. 4.40: Jute Braiding

2. Braided strand is stitched by coiling in required shape.

(a) Stitching jute yarn for coiling b) Stitching coils to make costar

Fig. 4.41: Making of costar

3. Outer edge is joined by making curves with different coloured yarns.

4. Extra fibers are clipped using scissors.

PRODUCTION PROCESS OF JUTE TABLE MATS AND COASTER USING FABRIC AS RAW MAETERIAL

For making jute table mats and coasters using jute fabric, following process is followed:

1. **Designing:** The table mats and coasters are designed as per the customer demand. Attractive embellishments are planned for the table mats and coasters such as embroidery, painting, printing, quilting, applique etc. Once, the design is finalized, a TechPack is made for further communication and to maintain standard.

2. **Pattern Making and Cutting:** After designing patterns are made as per the measurements and then the fabric is cut accordingly.
   Steps for making paper pattern:

   For table mat: On pattern paper make a rectangle of 18" width and 12" length, mark 1" seam allowance on all the four sides. Mark grain and seam line.

   For coaster: On pattern paper make a square of 4", mark 1" seam allowance on all the four sides. Mark grain and seam line.

   Mats and coasters are made and sold in sets of 6,8 and 12. Hence, for a set of 6, cut 6 pieces each for table mats and coasters.

3. **Embellishment/Surface ornamentation:** Embellish the cut parts with the predetermined embellishment technique.

Fig. 4.42: Jute table mats

4. **Edge Finishing and Stitching:** Once the mats and coasters are embellished, finish the raw edges using any of the techniques such as overlock, buttonhole stitch, overcast stitch, shaped facing or binding, lace, ribbon etc.

Fig. 4.43: Jute costars and table mats

For increased strength, the mats and coasters can be lined with a backing fabric or laminated with plastic sheet.

5. **Finishing and Packing:** After stitching and edge treatment, the mats and coasters are sent for finishing and packing where extra threads are cut, stains and dirt is removed, tags and labels are added and the final product is packed for shipping.

Activies

Design and develop table mats and coasters with Jute yarn.

Materials Required:

1. Jute yarn
2. Stitching material

Procedure:

Design and develop jute mats and coasters as explained in the session.
Design and develop table mats and coasters with Jute fabric.

Materials Required

1. Jute fabric

2. Stitching material

Check Your Progress

Question Answers

Briefly answer the following questions

1. Enlist the steps of production of a jute table mat using jute yarn as raw material.
2. Briefly explain designing and development of jute table mats and coasters using fabric as raw material.

Module 5 Work Area, Tools and Machines

Module Overview

In the handicraft industry, where creativity converges with precision, it is essential to understand the working area, tools and machines which will be used throughout to optimize the work output and maintain good health conditions. The handicraft industry is a dynamic and intricate sector, encompassing a multitude of processes, from design and fabrication to manufacturing and distribution. Amidst these intricate products created by handicrafts, the safety of workers and the assurance of a hazard-free environment stand as paramount concerns. Through a confluence of meticulous planning, stringent adherence to safety protocols, and fostering a culture of awareness, the handicraft industry strives to uphold the welfare of its workforce and create an environment where innovation thrives hand-in-hand with security.

The first step toward establishing a hazard-free working area is the identification and assessment of potential risks. The diverse nature of activities within the handicraft industry demands a comprehensive analysis of processes, machinery, and materials involved. This process involves a collaborative effort, wherein experts from various domains - including engineering, occupational health, and safety - join hands to scrutinize each facet of the production pipeline. From sharp-edged machinery to chemical substances used in dyeing and finishing, every element is evaluated for its potential to cause harm. Once identified, these hazards are meticulously documented, forming the basis for devising strategies to mitigate risks and create a safer working environment.

Key to achieving a hazard-free working area is the implementation of robust safety protocols. These protocols encompass a spectrum of measures, ranging from providing personal protective equipment (PPE) to imparting extensive training to the workforce. Adequate PPE, such as gloves, goggles, and ear protection, shields workers from direct exposure to potential hazards. Regular training sessions, on the other hand, empower employees with knowledge about the proper usage of machinery, handling of chemicals, and adherence to safety procedures. Such training not only prevents accidents but also cultivates a sense of responsibility among workers to uphold safety standards.

In the realm of the handicraft industry, machinery and equipment play a pivotal role. To ensure the safety of workers, regular maintenance of machinery is imperative. This includes routine inspections, timely repairs, and adherence to recommended usage guidelines. Additionally, the layout of the workspace should be meticulously planned to facilitate ease of movement, reduce congestion, and

minimize the risk of tripping or collision. Well-marked emergency exits and fire evacuation plans further contribute to a hazard-free environment.

In tandem with preventive measures, the industry must also adopt a proactive stance toward addressing emergencies. This involves devising contingency plans for various scenarios, from bad health to machinery malfunctions. Regular drills ensure that workers are well-prepared to respond effectively in crisis situations.

Sustainability, a growing concern across industries, also intertwines with safety in the handicraft sector. Embracing sustainable practices, such as eco-friendly dyeing methods and responsible waste management, not only minimizes environmental impact but also contributes to a safer workspace. For instance, the reduction of hazardous chemicals not only benefits the environment but also reduces the risk of exposure for workers.

In conclusion, the handicraft industry navigates a complex landscape, balancing innovation, creativity, and efficiency. Amidst these adverse conditions, the safety of its workforce and the establishment of a hazard-free working area emerge as non-negotiable priorities. Through meticulous risk assessment, stringent safety protocols, maintenance of machinery, and a holistic approach to well-being, the industry upholds its commitment to creating an environment where employees can flourish without compromising their safety. As the industry continues to evolve, so too will its commitment to the well-being of those who breathe life into its creations

Learning Outcomes
After completing this module, you will be able to: • Explain handling of tools and materials • Describe safe storage of material and waste management • Analyze use of tools and material according to work flow standards
Module Structure
Session-1: Explain handling of tools and materials safely and correctly
Session-2: Describe safe storage of material and waste management
Session-3: Analyze use of tools and material according to work flow standards

Session 1: Explain Handling of Tools and Materials Safely and Correctly

By reducing, combining, or eliminating unnecessary movement, material handling processes can be simplified. For example, use of gravity to help in movement of material with minimum manual force. The following points should be considered:

1. **Ergonomics:** The working conditions and facilities should be adapted to support the abilities of a worker, helps in reducing repetitive and strenuous manual labour movements and also emphasize on safety practices. Moreover, the work area should have plenty of space for the task to be accomplished; it should also be clean and ventilated.
2. **Space utilization:** We should focus on maximizing efficient use of space within a facility. It is important to keep work areas organized and free of unwanted clutter. We should try to maximize density in storage areas without compromising accessibility and flexibility, and to utilize overhead spaces efficiently.
3. **System:** All the movements of packages and storage should be coordinated throughout the production cycle i.e. from receiving, inspection, storage, production, assembly, packaging, unitizing and order selection, to shipping, transportation and the handling of returns.
4. **Environment:** We should take into consideration the use of energy and its potential environmental impact while designing the system and including/implementing the practices of reusability and recycling processes wherever possible. We should also try to incorporate safe practices for handling of hazardous materials.
5. **Automation:** Automation should be introduced to improve operational efficiency, responsiveness, consistency, predictability, automated material handling technologies as and when feasible or possible and wherever required.

Safe handling of tools and materials is of paramount importance in the apparel industry, where workers are constantly engaged in a wide range of tasks involving various tools and materials. Whether it's cutting, sewing, stitching, or assembling garments, the proper handling of tools and materials not only ensures the quality and efficiency of the production process but also safeguards the well-being of the workers. Adhering to strict safety protocols minimizes the risk of accidents, injuries, and occupational hazards, creating a conducive working environment.

One of the fundamental aspects of safe tool handling is proper training. All workers, regardless of their experience level, should receive comprehensive training on the correct usage of tools and equipment. This includes understanding the purpose of each tool, its potential hazards, and the appropriate safety measures. New employees should undergo thorough orientation sessions to familiarize themselves with the tools and materials specific to their roles. Additionally, regular refresher training should be conducted to reinforce safety protocols and introduce any updates in tools or procedures.

Personal protective equipment (PPE) is another essential element of safe tool and material handling. Workers should be provided with the necessary PPE, such as gloves, safety goggles, ear protection, and aprons, depending on the tasks they perform. For instance, when handling sharp cutting tools or working with potentially harmful chemicals, proper PPE ensures that employees are shielded from potential risks.

Proper tool maintenance is crucial for both safety and efficiency. Tools and equipment should be inspected regularly to identify signs of wear, damage, or malfunction. Any defective tools should be promptly repaired or replaced to prevent accidents caused by faulty equipment. Dull blades or worn-out parts can lead to unintended accidents due to increased force required during usage. Regular maintenance not only extends the life of tools but also contributes to the overall safety of the work environment.

Organization and workspace design play a role in promoting safety. Workstations should be organized and clutter-free, with tools and materials properly stored when not in use. Clearly labeled storage areas for tools and materials help prevent confusion and ensure that workers can locate what they need without risking unnecessary accidents. Properly organized workspaces also minimize the risk of tripping, falling, or mishandling tools due to cramped or cluttered conditions.

Communication among team members is vital for safe tool and material handling. If there are changes in procedures, tools, or materials, these updates should be communicated effectively to all relevant personnel. Encouraging open dialogue about safety concerns and sharing best practices can create a culture of safety consciousness throughout the organization.

In conclusion, the handicraft industry relies heavily on the skilled and diligent work of its employees, making their safety a top priority. Safe handling of tools and materials not only prevents accidents and injuries but also enhances the overall efficiency and quality of production processes. Through proper training, the use of personal protective equipment, regular maintenance, organized workspaces, and effective communication, the handicraft industry can create a work environment where workers feel valued, protected, and empowered to contribute to the success of the business while staying safe.

Cleaning and Maintenance of tools:

Regular cleaning and maintenance of tools goes a long way in increasing the life and efficiency of tools. Thus, the output or quality of work is also ensured if we take care of our tools and equipment.

High levels of dust interfere with efficient production and require cleaning and maintenance operations that may otherwise spoil materials and finished products. Proper cleaning procedure and maintenance protocol is an immediate, low-cost measure to enhance overall cleanliness, consistency and contamination control within workstations. Best practices should be followed with application of specific techniques of wipe down and particle control. Some of the most common contamination include solid dust, liquid, bacteria, fungus, human skin cells and hair, spills and leaks, lint, fibers, and more.

Improved conditions usually mean increased output, higher productivity and quality. There are simple and inexpensive ways to control most of the environmental problems. Maintenance of tools often result in cost savings, productivity benefits and increased safety of workers.

Points to be considered in cleaning and maintaining the tools are as follows-

- Avoid placing the materials and tools on the floor to avoid any damages or accidents.
- Keep all the tools and material at their designated places. Make use of racks, shelves which are properly marked for this purpose.
- Keep the work area free of any unwanted material like extra set of cartons, bins etc.
- The floor should be made anti slippage with the help of anti-skid mats or tiles.
- Ensure regular cleaning all the tools after every use.
- Keep all the tools and material back into their covers after use. This will not only prevent them from dust but will also prevent any accidents or injuries.
- Allocate proper space for operation, outputs and inputs.
- A regular system of inspecting, cleaning and repairing is an essential part of cleaning and maintenance of tools.

It is very important to handle the equipment carefully and safely in the garment industry and train all workers in a manufacturing unit to follow the same effectively.

Clothing and Personal Protection

Clothing and personal protection must be worn wherever they are prescribed. Close fitting clothing should be worn near machinery with moving parts. Loosely, draped garments like scarves, dupatta, bows, ribbons and loose sleeves are dangerous use of over coat is advised to be worn in such cases. Long hair should be tied up tightly and covered with Cap. Jewellery, watches and rings should not be worn. There are personal protection equipment's such as hair protectors, ear protectors, gloves, safety glasses and shoes.

Types of Personal protective equipment

Latex Gloves

Purpose: - To avoid any chemical contamination while handling Chemicals.

User Department: - Chemical Store, Washing, ETP, STP

Fig. 5.1: Latex Gloves

Acid-Alkali Hand Gloves

Purpose: - Used for handling Acid/Alkali

Fig. 5.2: Acid Gloves

Chemical Splash Safety Goggle / Mechanical Safety Goggles

Purpose: -For protection of eyes against chemicals.

Fig. 5.3: Safety Goggles

Different types of Masks:

Organic Vapour Mask Purpose:- For protection against organic chemical vapours.	
Particulate Respirator Purpose:- For protection against chemical dust.	
Chemical Mask Purpose: Used for protection against high concentration of organic vapours.	
Dust Mask Purpose:- For protection against normal dust particles.	
Gum Boot Purpose:- For protection of feet while working in wet processes. (For Washing & ETP operators)	
Ear Muff or ear plugs Purpose:- For protection of ears while working in high sound intensity areas.	

Leather Apron Purpose:- For protection of body while working at high temperature areas.	
Safety Helmet Purpose:- For protection of head against falling objects, trips or falls.	

Fig. 5.4: Personal protective equipment's

Clear demarcations and sign boards:

Clear demarcation of areas is required at places where there is possibility of hazards or accidents.

Prohibited areas which are marked are as follows-

1. Storage of chemicals
2. Operation of machinery
3. Presence of water on the floor
4. Loud noise areas: areas with high sound intensity.
5. High voltage current.
6. Release of poisonous fumes or gases.

There are threats based on the nature of the operations and workers have to be trained to understand these hazards and take proper precautions.

Activies

Visit a handicraft or jute industry and prepare a report on different types of tools and equipment's used for finishing and packing and write about its maintenance and cleaning method used.

Materials used:

1. Register/File
2. Pens and pencils
3. Eraser
4. Ruler

Procedure:

1. Visit a handicraft or jute industry.
2. Study the tools and equipment used for finishing and packing and its cleaning and maintenance methods.
3. Prepare a report and submit the same.

Fill in the Blanks

1. Workers should be provided with the necessary _____ such as gloves, safety goggles, ear protection, and aprons, depending on the tasks they perform.
2. Regular _____ of tools goes a long way in increasing the life and efficiency of tools.
3. _____is used for protection of feet while working in wet processes.
4. _____is used for protection of ears while working in high sound intensity areas.

Question Answers

1. Explain safe handling of tools and equipment.
2. Describe cleaning and maintenance of tools and equipment.

Session 2: Describe Safe Storage of Material and Waste Management

Safe working practices, risk assessments, maintaining standards are recommended practices in the industrial environment. The factors of risk are high since the workers constantly interact with numerous machineries, processes, and practices. The risk can be decreased by evaluating and registering them by training the workers, introducing and practicing safety measures, conducting emergency incident practice drills, displaying signboards, and ensure following of all standard procedures applicable at the workplace.

Health and safety at work is the responsibility of both employers and the employees. Manufacturers are required by law to follow strict rules and regulations to make sure that the workers are protected from possible dangers and using machinery and handling materials. The workers must follow all safety rules and instructions to keep themselves and those around them safe.

The dangers, hazards or risks involved in making a product can be identified, described and listed. This is known as risk assessment. At the workplace, it is essential to know what might cause harm or injury to people or the environment, therefore safety precautions and systems can be put in place to prevent accidents. The following precautions need to be followed–

- Carry out risk assessments.
- Display warning notices, safety rules and fire exit signs.
- Ensure that machinery, equipment, tools and materials are stored safely, have safety guards, are safe to use and are regularly tested for their safety standards.
- Ensure that chemicals used in manufacturing processes are recorded, stored and used safely and correctly. One must also ensure safe disposal or recycle of the used chemicals.
- Regular checks must be conducted for ensuring that the environment is safe with hygienic work areas and sufficient ventilation to remove dust and fumes, and has also has noise-level control systems.
- Install storage racks, shelves and containers. For heavy items use wooden pallets. For light items use overhead space by installing overhead racks along walls that are less frequently used. Gain productive space by introducing multi-level racks which saves the floor space.
- Clean and free floor space results in easy accessibility to work items and tools, and improved inventory control.

- Provide a place for each tool and work item- Consider the quantity, size, shape and weight of the necessary items in order to select the most appropriate means and place of storage.
- Identify tools that are most frequently used. Place the most frequently used tools such as spot guns and scissors which are constantly used in a location where they can easily be reached without leaning. Avoid placing materials on the floor. Provide a place for each tool and work item.

One should not lift loads that are higher than guidelines of lifting. We must make sure that the lifting operations are more efficient and safer.

Workers must ensure reporting hazards and potential risks/ threats to supervisors or any other authorized personnel. Follow organization procedures for shutdown and evacuation when required.
Workers must follow environmental control measures such as cleaning regularly and properly, do not spread dust, make local ventilation cost-effective and replace a dangerous substance with a safer one.

Guidelines for safe storage of chemicals:

- All containers, bins and bottles of chemicals should be well labelled.
- Only authorized personnel should be allowed to handle the chemicals and they should also be aware about handling instructions.
- Chemical material should always be stored in designated areas that are designed and constructed for that use.
- The storage location should be out of direct sunlight and heat.
- The chemical storage areas should also be away from high occupancy areas.
- Away from emergency exit and evacuation areas.
- The storage area where chemicals are kept should be designed with floors which are not affected by chemicals or do not absorb the chemicals.
- Mostly we require some kind of ventilation facility like a mechanical exhaust fan for providing adequate ventilation and avoid collection of highly flammable or toxic fumes in the work area in the event/time of a chemical leak or a spill.
- All chemical storage areas should be secured /locked when the factory is not in operation and only authorized personnel should be allowed to handle the chemicals.
- Operations involving smoke and heat should not be performed near the chemical storage.
- Electrical supply, switches, wiring etc. should preferably be outside the chemical storage areas.

- Equipment such as generators, boilers, etc. should not share the same space as chemical storage
- Provision of fire extinguisher should be there but these should also be kept outside the storage room and not inside.
- While storing chemicals, their nature and compatibility issues should be kept in mind. For example, chemicals which are corrosive or oxidizing in nature should not be stored with flammable material. There should be a distance of at least 5 meters between such chemicals if a separate storage is not possible.

One must ensure availability of any absorbent material near the storage area to remove/absorb any liquid chemical from the floor or other surfaces after a chemical spill or leak. Sand may be used for this purpose, although commercial adsorbent products are preferable. In addition to this, one should also ensure availability of equipment such as shovels, a container and suitable PPE protective gloves, eyewear, etc. depending upon the extent of the spill and the hazards of the particular chemical.

Proper usage of materials to minimize waste:

Some amount of manufacturing waste is always generated in almost every manufacturing unit. Thus, it becomes mandatory to establish and implement practices for minimizing waste generation. Different production processes in handicraft and textile units such as washing/drying, warp preparation, weaving, dyeing, printing, finishing, quality control, and warehousing etc. result in waste-generation. Some types of commonly observed wastes in textile and handicraft industry include fibre waste, yarn waste, fabric scraps, chemicals, untreated dye solutions, finishing agents, cutting and stitching waste etc. Wet finishing processes use up to 200 liters of water per kilogram of fibre. Thus, the largest chunk of waste in this sector is water (as per volume).

Following are the ways to minimize the generation of waste:

1. Efficient Inventory Management: One can reduce manufacturing waste, by controlling the excess or not required materials being used in the manufacturing or other process. Inventory should be managed efficiently and only required quantity of raw material should be procured to minimize wastage.

2. Reduce Packing Materials: Product packing may be redesigned to ensure that minimum amount of materials is used. Incorporation of reusable or recyclable packing content should be incorporated for packing.

3. **Recover and Reuse:** Recover waste from onsite and offsite locations. Recycling is another popular choice. Recycle materials like fabric, paper, plastic, and metal

regularly, and avoid recycling hazardous materials as they rarely have any environmental benefits.

4. Establish a Preventative Maintenance Schedule: Regular maintenance should be performed. It is more beneficial to control the costs to prevent a breakdown instead of reacting to a breakdown later.

5. Label and Organize the Warehouse Properly: All the locations of inventory, tools, supplies, and assets necessary to manufacturing and other processes must be clearly marked throughout the warehouse. This may result in decreased time being spent on searching for the right tool needed for an urgent repair. One should always replace the faded tags and repaint the floor lines regularly.

6. Minimize Water Usage: Industrial sludge and wastewater make up a significant portion of manufacturing waste streams. One can reduce these elements by minimizing water usage in the operations like dyeing and finishing processes. Installing a treatment system to recycle waste water can contribute to minimize this type of waste. Employees should also be encouraged to cut down on drinking water from plastic water bottles as it adds up to major portion of plastic waste generated. Switching to drinking water in glasses or promoting the use of reusable bottles in the workplace is an easy solution to the problem.

7. Volume Reduction: Volume reduction refers to the segregation techniques that remove the hazardous portion of waste from the non-hazardous portion. As a result of using volume reduction technique, there is a considerable reduction in the volume and the cost of waste disposal.

They can be broadly divided into two categories — waste concentration and source segregation. The former may increase the likelihood of the material being reused or recycled and the latter consists of different types of materials within the waste being treated separately so that the cloth value in the bulk can be recovered.

Fig. 5.5: 3R's of Waste Management

Disposal of waste at designated locations:

Proper waste disposal within the apparel industry plays a pivotal role in safeguarding the environment. The industry's rapid growth has resulted in escalating waste generation, often encompassing fabric scraps, dye chemicals, packaging materials, and more. By adopting efficient waste management practices, significant environmental benefits can be achieved. Implementing recycling and upcycling initiatives can reduce the accumulation of fabric remnants. Reusing scraps for new products or donating them to crafters minimizes landfill contributions. Responsible disposal of dye chemicals and other hazardous materials prevents water and soil contamination. Employing biodegradable and eco-friendly packaging materials diminishes the burden on landfills and ecosystems. Furthermore, raising awareness and educating stakeholders about sustainable practices fosters a culture of environmental responsibility. Collaborations with waste management experts can optimize waste segregation and recycling processes. Government regulations and industry standards can also be instrumental in enforcing proper waste disposal practices. Ultimately, embracing proper waste disposal techniques in the apparel industry not only curtails environmental degradation but also promotes a circular economy. By reducing waste, conserving resources, and minimizing pollution, the industry can contribute to a healthier planet for current and future generations.

One should follow the following ways of waste disposal:

- The types and amounts of hazardous wastes generated should be identified and segregated and the waste disposal method for each category of waste should be determined.
- Sorting of waste makes sure that the recyclable items are put to correct use and not go in waste. The responsibility of keeping a track of the bins and finding a feasible solution for elimination, reduction or reuse of the waste generated should be carefully assigned to selected employees and workers and there should also be clear cut policy for this.
- Hazardous and nonhazardous wastes should not be mixed. Disposal of hazardous waste that cannot be treated or recycled should be done at a secure, permitted and designated place which has no access to the general public or any unauthorized personnel.
- Industrial shredders can be used to reduce waste by condensing cloth material, wood, rubber, and plastics to a fraction of their original size.
- Bins/Containers containing hazardous waste should always be kept covered only except when workers are transferring hazardous waste into them.
- Fabric waste from checking, cutting and sewing departments should also be stored at a designated area and should be disposed as per the disposal schedule.

- The benefits of reducing the volume of solid waste generated at a craft cluster include a positive effect on the environment, an economic advantage to the industry and better community relations.

Activies

Visit any craft cluster and study their methods and ways of waste disposal and prepare a report on the same.

Materials used:

1. Register/File
2. Pens and pencils
3. Eraser
4. Ruler

Procedure:

1. Visit any craft cluster.
2. Study the methods and ways of waste disposal, stick pictures to support the report.
3. Prepare a report and submit the same.

Check Your Progress

1. _____ should be managed efficiently and only required quantity of raw material should be procured to minimize wastage.
2. Product _____ may be redesigned to ensure that minimum amount of materials are used.
3. _____should be done of materials like fabric, paper, plastic, and metal regularly.
4. _____ should be performed. It is more beneficial to control the costs to prevent a breakdown instead of reacting to a breakdown later. (
5. Industrial _____ make up a significant portion of manufacturing waste streams.
6. Proper _____ within the apparel industry plays a pivotal role in safeguarding the environment.

Question Answers

B. Write short answer for the following:

1. Explain about safe storage of chemicals in any craft cluster.
2. Describe managing waste and waste disposal generated in craft clusters.

Session 3: Analyze use of Tools and Material According to Work Flow Standards

Analysing tools and materials according to workflow standards is a crucial aspect of mastering the craft of working with jute and other handicraft materials. Achieving excellence in this field requires a deep understanding of how the right tools and materials can enhance the creative process, efficiency, and the overall quality of the final product. Here's a comprehensive overview of how to analyse tools and materials in accordance with workflow standards:

1. Tool Selection and Evaluation:

- **Purpose and Functionality**: Begin by understanding the specific tools required for your craft. Jute and handicrafts involve a range of tasks, from cutting and shaping to weaving and decorating. Each tool should serve a distinct purpose, and its functionality must align with your workflow.
- **Quality and Durability**: High-quality tools are essential for consistent results. Tools should be made of durable materials to withstand continuous use. Investing in well-made tools will pay off in the long run.
- **Ergonomics**: Consider the ergonomics of your tools. Comfortable and ergonomically designed tools reduce fatigue and increase productivity during long crafting sessions.
- **Maintenance and Sharpening**: Regular maintenance and sharpening of tools are necessary to keep them in optimal working condition. Dull or damaged tools can hamper the workflow and compromise the quality of the work.

2. Material Assessment:

- **Jute Quality**: The quality of jute is a crucial factor. Assess the texture, strength, and color of the jute to ensure it meets your project requirements. Premium-grade jute provides a polished finish and durability.
- **Dye and Colourfastness**: If you're planning to dye the jute, analyse the dyes for their compatibility with jute, colourfastness, and eco-friendliness. Ensure that the colors won't fade or bleed over time.
- **Additional Materials**: In the handicraft industry, you may use other materials such as beads, threads, and decorations. Choose materials that complement the jute and serve the intended purpose, keeping in mind their quality and compatibility.

3. Workflow Standards:

- **Standardized Processes**: Develop a set of standardized processes for your craft. This includes precise measurements, cutting techniques, and assembly procedures. These standards should help streamline your workflow and minimize errors.
- **Time Management**: Time is often a critical factor in the handicraft industry. Analyze your workflow to identify areas where time can be saved without compromising the quality of the final product. This may involve batching similar tasks, improving efficiency, or automating certain steps.
- **Quality Control**: Establish a system for quality control, including regular checks during different stages of production. This ensures that every piece you create meets the highest quality standards.

4. Workspace Organization:

- **Tool Accessibility**: Keep tools organized and easily accessible. A well-organized workspace reduces the time spent searching for tools and materials, thus improving efficiency.
- **Safety Measures**: Implement safety measures to protect yourself and others. This includes proper storage of sharp tools, ensuring proper ventilation for chemicals, and maintaining a clean and hazard-free workspace.

By analysing tools and materials according to workflow standards, you'll not only enhance the quality of your jute and handicraft products but also increase your efficiency and productivity. This meticulous approach to craftsmanship sets the foundation for excellence in the industry and allows you to create stunning, durable, and distinctive pieces that reflect your mastery of the craft.

Activies

Visit any craft cluster and study their workflow systems and prepare a report on the same.

Materials used

1. Stopwatch/Timer
2. Pens and pencils
3. Eraser
4. Notebook
5. Standard Workflow guide

Procedure:

1. Visit any craft cluster. Present participants with a jute craft project that involves multiple steps, such as making a simple bag.
2. Provide a stopwatch or timer to measure the time taken to complete the project.
3. Ask participants to follow the standard workflow guide while completing the project.
4. Compare the time taken to the standard time in the guide and assess whether participants adhered to the workflow standards.
5. Discuss any deviations or improvements in efficiency and quality achieved during the exercise.

Check Your Progress

1. In the jute and handicraft industry, selecting high-quality tools is essential to ensure _____ and consistent results.
2. Material assessment includes evaluating the quality of jute, which includes factors like texture, strength, and _____.
3. The use of ergonomic tools in your craft significantly reduces _____ during long crafting sessions.
4. To maintain optimal tool performance, regular _____ and sharpening are necessary.
5. A well-organized workspace enhances efficiency by reducing the time spent searching for tools and materials and improving overall _____.

Question Answers

Write short answer for the following:

1. Why is it crucial to analyse the quality of jute materials when working in the jute and handicraft industry?
2. How can ergonomic tools improve the efficiency and quality of work in jute and handicraft projects?
3. What are the key elements to consider when creating standardized processes for jute and handicraft projects?
4. Why is safety a critical consideration in a jute craft workspace, and how can safety hazards be mitigated?

Module 6	Health, Safety and Security at Workplace

Module Overview

In the jute and handicraft workplace, health, safety, and security are of utmost importance. Craftsmen and artisans work with a diverse range of tools, materials, and processes, making it essential to establish a safe and secure environment that not only safeguards the well-being of the workers but also preserves the quality of the crafted products. Tool and equipment safety is a fundamental aspect, where regular maintenance, cleaning, and storage of tools are emphasized to prevent accidents and maintain efficiency. Artisans receive training in the safe and proper use of these tools. Material safety is also vital, with a focus on the management of hazardous substances like dyes and chemicals. Personal protective equipment (PPE) such as gloves, goggles, and masks is encouraged to mitigate risks. Workspaces are organized to ensure safety and efficiency. Clutter is minimized to prevent tripping hazards, and clear, safe pathways are established for smooth movement within the workspace. Ergonomics plays a role in workstation design to reduce physical strain. Regular breaks are encouraged to prevent fatigue and discomfort. Fire safety measures are in place, including fire extinguishers and fire drills to prepare workers for emergency situations. Security is another concern, with access control and inventory management to prevent theft or unauthorized use of materials and tools. First aid supplies and medical care are readily available, and workers are trained in emergency response procedures. Clear communication of safety policies and procedures is a priority, ensuring that everyone is aware of the rules and their consequences. Incident reporting and investigation processes are in place to prevent the recurrence of accidents or near misses. Ongoing training sessions are conducted to keep workers informed about best practices. Ultimately, a commitment to health, safety, and security not only protects the workforce but also enhances productivity and creativity within the jute and handicraft industry.

Learning Outcomes

After completing this module, you will be able to:

- List and analyze potential hazards at workplace
- Describe health, safety, and security at workplace
- Explain environmental management procedures, security details, potential accidents and emergencies

Module Structure

Session-1: List and analyze potential hazards at workplace

Session-2:	Describe health, safety, and security at workplace
Session-3:	Explain environmental management procedures, security details, potential accidents and emergencies

Session 1: Analyses of Potential Hazards of Workplace

Hazard is a potential source of harm that can cause temporary and permanent damage or may even prove to be fatal if neglected.
The first step towards workplace risk assessment is to identify the potential risks/hazards at the workplace. To overcome these hazards in a nominated person is appointed for conducting formal risk assessments; however, it is everyone's responsibility to be careful and mindful of possible and sudden hazards at the workplace and minimize the risk for self and for people around.

Not all hazards are obvious, and they will be unique to every workplace depending on the type of process flow. This can make it difficult to immediately identify and protect all the employees from it. Therefore, it is important to study various types of hazards and knowing how to keep work area free from potential hazards.

Different types of potential hazards:

The handicraft sector plays a significant role in the global economy, providing clothing, textiles and other hand-crafted items to millions of people around the world. However, this industry is not without its hazards, as the various stages of production present potential risks to workers' health and safety. To ensure a safe working environment, it is crucial to identify these hazards and implement appropriate safety measures. This article delves into some common hazards within the handicraft sector and outlines essential safety measures that should be taken to protect workers.

Chemical Hazards:

Any craft cluster involves various chemicals, such as dyes, solvents, and finishing agents, which can pose risks to workers. These chemicals can cause skin irritation, respiratory problems, and even long-term health issues like cancer. To address these hazards:

- Provide proper training to workers about the safe handling and use of chemicals.
- Ensure the use of personal protective equipment (PPE) such as gloves, masks, and goggles.
- Implement effective ventilation systems to control chemical fumes and dust.

Fig. 6.1: Sign of Chemical Hazards

Ergonomic Hazards:

Repetitive tasks, poor posture, and improper workstation design can lead to musculoskeletal disorders among apparel industry workers. To mitigate ergonomic hazards:

- Design workstations with adjustable components to accommodate different body types and sizes.
- Implement regular breaks and rotation of tasks to prevent prolonged exposure to repetitive motions.
- Provide ergonomic training to workers to promote proper posture and lifting techniques.

Fig. 6.2: Sign of Ergonomics Hazard

Mechanical Hazards:

Machinery used in the jute and handicrafts, such as sewing machines and cutting tools, can cause injuries if not used correctly.

- Conduct regular maintenance and inspections of machines to ensure they are in safe working condition.
- Provide proper training to workers on the safe operation of machinery.
- Install machine guards and safety devices to prevent accidental contact with moving parts.

Fig. 6.3: Sign of Mechanical Hazards

Fire Hazards:

The presence of flammable materials, such as fabrics and chemicals, increases the risk of fire in the workplace.

- Install fire detection and suppression systems throughout the facility.
- Maintain clear and unobstructed evacuation routes and conduct regular fire drills.
- Train workers in fire safety procedures and the use of fire extinguishers.

Fig. 6.4: Sign of Fire Hazards

Electrical Hazards:

Electrical equipment is widely used at any workplace, and improper use can result in electric shocks, burns, or even fires.

- Regularly inspect and maintain electrical equipment and wiring to prevent hazards.
- Ensure workers are trained to handle electrical equipment safely and know the location of emergency shut-offs.

Fig. 6.5: Sign of Electrical Hazards

Noise Hazards:

The constant noise from loom/machinery in the apparel handicrafts can lead to hearing impairment and other health issues.

- Provide workers with appropriate hearing protection, such as earplugs or earmuffs.
- Implement noise control measures, such as enclosing noisy machines or using sound-absorbing materials.

Fig. 6.6: Sign of Noise Hazards

Biological Hazards:

In some instances, biological hazards like bacteria and viruses can be present in the craft clusters, particularly in environments with poor hygiene practices.

- Maintain proper sanitation and hygiene standards in work areas.
- Provide adequate facilities for handwashing and personal hygiene.
- Educate workers about the importance of maintaining cleanliness and hygiene.

Fig. 6.7: Sign of Biolocial Hazards

Safety Culture and Training:

Developing a strong safety culture is vital in preventing accidents and promoting a safe working environment.

- Conduct regular safety training sessions for all workers, covering hazard recognition and proper safety procedures.
- Encourage workers to report hazards and near-miss incidents promptly.
- Involve workers in safety committees or discussions to foster a sense of ownership over safety practices.

Potential hazards risks and threats based on nature of operations

Identifying potential hazards and risks at workplace involves finding things and situations that could potentially cause harm to people based on the nature of operations. Hazards generally arise from the following aspects of work.

- Physical work environment

- Equipment and Materials
- Working tasks and how the way they are performed

In a craft cluster the work process may have to face different types of hazards. Identification of each of these hazards is necessary. For example, a workplace may have moving parts, noise, hazards associated with manual tasks and psychological

Hazard /Risk	Potential Harm/Loss
Manual Task	Overexertion or repetitive movement can cause muscular strain.
Electricity	Exposure to live electrical wires can cause shock, burns or death from electrocution. Low light can affect the eyesight of the artisans.
Machinery and Equipment	Being caught by moving parts of machinery can cause fractures, bruises, lacerations, dislocations, permanent injuries or can be fatal.
Noise	Exposure to loud noise can cause temporary/permanent hearing damage
Working Environment	Falling objects, falls, slips and trips of people can cause fractures, bruises, lacerations, dislocations, concussion, permanent injuries or can be fatal.
Extreme Conditions	Heat can cause burns; heat stroke or fatigue Cold can cause hypothermia or frost bite.
Psychosocial hazards	Effects of work-related stress, bullying, violence and work-related fatigue can cause depression and anxiety.

hazards at the workplace. Some of them can be explained as follows-

Keeping work area free from potential hazards:

Workstations have to be kept free from any potential hazard to ensure the safety of workers and the work place. Therefore, following measures can be followed to maintain the safety and security –

1. Environmental Control Measures

Hazardous substances in one form or another can be found in almost all small and medium-sized enterprises. The jute and handicrafts generates a lot of dust from fabrics being cut and sewn, heat and noise from machinery. There are simple and inexpensive ways to control most of the environmental problems. Improvements often result in cost savings, higher productivity and increased safety of workers.

2. Regular and Proper Cleaning

Dust originates from fabrics and threads, from cutting and sewing to packing operations. It is very common to see small clothing enterprises with ceilings and walls full of dusty cobwebs.

One low-cost cleaning method is sweeping the floor carefully with an appropriate broom and accompanying dust pan to prevent dust from spreading. Spraying water on the floor before sweeping will avoid dust remaining airborne.

3. Cost-effective Local Ventilation

Local ventilation should only be considered as a means of reducing chemical hazards when other means have failed.

There are cost-effective ways of improving ventilation:

- **Use proper fans:** Apart from those used for ventilating workstations, fans may be utilized to remove dangerous substances from the workplace. Contaminated air can be pushed or blown outside by having more open windows.
- **Good Lighting for Quality Products:** Good lighting does not necessarily mean more light bulbs and more use of electricity. Natural lighting is usually a better option than the bulbs. But if there is difficulty in arranging for a natural lighting through windows and ventilators, it's important that the bulbs and other sources of artificial lights should be well-maintained. A good lighting arrangement is directly proportionate to an efficient workforce.

  Lighting requirements are mainly affected by following factors:

  - The type of operation or task to be done.
  - The eyesight of the worker, if any worker has very good eyesight then they can work efficiently in dim light too but workers with poor eyesight require optimum and efficient lighting system
  - Area where the work is being done. If the work area has ample day light and clear, open windows then requirement of light is not that important. But during night shifts and in closed areas without adequate windows efficient lighting system is must.

- **Full use of Daylight**

The higher and bigger the window, the more of day light can be accessed. It is important to paint the walls in lighter shades which not just give a sense of space to a room, but the workstation would look illuminated. In a store we should have be very careful with the light as prolonged exposure to light can cause degradation of fabric color/shade.

Activies

Activity 1
Collect the data and make a report on potential risk and hazards of industry.

Material Required:

1. Practical File
2. Coloured pens and pencils
3. Ruler
4. Eraser
5. Pictures of different hazards in an industry

Procedure:

1. Search and collect the data and pictures of different types of hazards of an industry.
2. Place the pictures in the practical file and label the same.
3. Write the description and make a report.

Check Your Progress

A. Fill in the Blanks:

1. _____is a potential source of harm that can cause temporary and permanent damage or may even prove to be fatal if neglected. (Hazard)
2. _____can cause skin irritation, respiratory problems, and even long-term health issues like cancer. (chemicals)
3. Repetitive tasks, poor posture, and improper workstation design can lead to_____among apparel industry workers. (musculoskeletal disorders)
4. The presence of_____, such as fabrics and chemicals, increases the risk of fire in the apparel industry. (flammable materials)
5. The constant noise from_____in the apparel industry can lead to hearing impairment and other health issues. (machinery)

B. Write short answers for the following:

1. What do you mean by potential hazards? Name and discuss any three.
2. Describe measures for keeping the work area free from potential hazards.

Session 2: Health, Safety, and Security at Workplace

A healthy worker is a productive worker. Poor health is the most common reason workers take a leave of absence from the workplace. Many illnesses are a result of the lack of knowledge of personal hygiene among workers and can be prevented by following simple rules of hygiene.

The incidences of various illnesses can be considerably reduced by a basic education in health and hygiene. Common health issues faced by the workers should be identified and marked clearly by the management and the workers should be trained for prevention and control of these problems.

The factory management must also remain alert and respond urgently to various health issues that can emerge. Good personal hygiene habits lead to better health and reduced illnesses. Poor personal hygiene can lead to some minor side effects, like body odour, bad breath and greasy skin. However, it can also result in more serious health issues. Hence, workers should be given mandatory training in health and hygiene related issues.

Importance of Personal Hygiene:

Personal hygiene is important mainly because it saves us from illnesses and ensures good health. It also has many other benefits. These include:

- Neat and Tidy appearance
- Improved stamina and efficiency
- Boosts self confidence
- Contributes toward motivation
- Lesser leaves and absenteeism

Unsatisfactory quality and quantity of drinking water, lack of sanitation and hygiene can cause a number of illnesses. These factors can affect individually or in combination also. The diseases caused by poor sanitation and hygiene mostly affect individual employees and are not communicable. Thus, they can be controlled but there are situations where lack of hygiene and sanitation may simultaneously affect many employees. Such a situation is difficult to control and may result in huge loss of work. The latter is often indicative of poor working conditions in the factory.

The prevention of diseases related to water, sanitation and hygiene is possible with simple control measures at the factory level. Workers must be regularly trained in hygiene and sanitation practices.

The following mentioned are few tips for dealing issues regarding good personal hygiene about workplace health and safety.

Ensuring personal hygiene and care of body:

- Hand Wash: Poor hand hygiene increase the vulnerability to bacteria and potential transfer or introduction of microbes such as viruses and fungus. Hence washing hands frequently, wearing gloves etc. should be strictly followed.
- Hands must be washed on regular intervals with an effective hand disinfectant liquid/solution.
- Wear clean uniforms/ Protective clothes during working in the area along with cap, eye glass, face mask and footwear that adequately covers their feet to protect workers and ensure their safety.

Benefits of a healthy lifestyle

The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being". It's not an exaggeration when we say that health is wealth because it affects a person's productivity, efficiency, energy and behaviour. Some of the benefits of a healthy lifestyle are increased concentration, sharp memory and it also gives an emotional boost.

Minimizing health and safety risks

1. **Identify and reduce the risks –** Once the hazard has been identified at the workplace, appropriate steps for reduction of risk and work-related injuries must be taken.
2. **Reducing workplace stress -** Common causes of workplace stress includes long working hours, heavy workload, job insecurity and conflicts with co-workers and seniors. Stress can lead to depression, sleeping difficulties and often lowers the ability to concentrate.
3. **Using correct tools and equipment –** Use of correct tools and equipment is advisable. For e.g to cut the extra thread of seam, use of scissors is safe and efficient than use of a blade or knife.
4. **Wear suitable protective equipment –** Correctly worn equipment such as earplugs, earmuffs, hard hat, safety goggles, gloves or full-face mask can dramatically reduce risk of injury.
5. **Staying sober** - Alcohol and drugs are a contributing factor in around three per cent of workplace fatalities. Workers should avoid indulging in such unethical practices at work.

The value of physical fitness, personal hygiene and good habits

Performance of a worker is directly related to the health of the worker. Hence it is important to train and educate the workers on good health and hygienic habits.

1. **Physical Fitness:** Physical activities have many health benefits for workers, regardless of whether or not physical fitness is a requirement for their jobs. However, a fit and healthy workforce is one of the most valuable assets of the company. Therefore, employers need to make more effort to encourage physical activity. Periodical health check-ups and workshops should be arranged by the company to maintain good health of the employees.
2. **Personal Hygiene and Good Habits:** Personal hygiene refers to the cleanliness, appearance and habits of employees. Personal hygiene and good habits don't only make workers look and feel good, but also makes their co -workers feel safe and comfortable. Personal hygiene improves employee's confidence and helps in maintaining employee productivity. It promotes a safe and healthy environment at the work place.

Do's and Don'ts of Personal Hygiene at the Workplace:

- Workers should clean themselves and should not indulge in littering
- Workstations should be kept clean and dust free by wiping them regularly.
- Tea and food should always be consumed at designated spaces and all the utensils and crockery should be cleaned immediately and regularly.
- Workers should be trained in proper hygiene and practices and should follow it sincerely.
- All the workers and employees should adhere to organizational hygiene policies.
- Unhygienic practices like sneezing and coughing in open should be avoided.
- Washrooms must be kept clean and workers must wash their hands thoroughly with soap after using wash rooms.

Safe Working Practices and Organizational Procedures:

Every organization Safety measure include proper training of machine operators, which is essential throughout the production line and across the workplace. Safety can be greatly enhanced by introducing automation in machinery and processes for material handling. It is highly effective particularly for heavy loads or wherever high-speed machinery is used. It is beneficial where heat, sharp blades or needles are involved. Safety devices or sensors are used to check whether machine setting is correct and to stop machinery in case of emergency.

- All Organizational policies and procedures should be followed for issues related to security, material handling, potential hazards etc.
- All compliances should be strictly followed. Special care and attention should be paid to health and safety regulations and procedures in case of fire, chemical hazards, bio-hazards, etc.
- Maintain distance from moving machinery and stay within designated areas.
- Maintain a clean, neat and orderly working area
- Proper ventilation facilities must be designed and implemented.
- Safety guards and protective clothing, gloves and footwear worn.
- Displaying educational posters is a powerful way to educate workers. It is extremely effective as it delivers a consistent message, and using pictures that are a medium of effective communication targeting a specific behavior. Examples, which are used in garment factories include posters of lifting postures, wearing mask properly wherever required, importance of sanitation to promote good health and surroundings etc.

Safety Measures

- Workers should use and maintain personal protective equipment as instructed.
- They should also carry out their activities in line with approved guidelines and procedures
- Use and dependency on intoxicants such as liquor, cigarettes etc. should be totally avoided in workplace and a healthy lifestyle should be maintained.
- Faults and malfunctions in machinery and equipment should be reported or dealt with urgently and with utmost sincerity.
- Storage of materials and equipment should be done in line with manufacturer and organizational requirements.
- Seek clarifications, from supervisors or other authorized personnel in case of perceived risks.
- Keep checking the workplace and work processes at regular intervals for potential risks and threats.
- Workers must report risk of potential threats, accidents to supervisors or any other authorized personnel in charge.
- Workers should undertake all training and drills related to first aid, fire-fighting and emergency response very sincerely and should not do it just for the sake of formality.

- In situations where shutdown and evacuation are mandatory or compulsory, workers should follow standard organizational procedures.
- Environmental hygiene should not be neglected – regular checks of waste disposal, drainage, sewage and effluent treatment systems should be instituted.

Hazard Control:

1. Sharp Objects the worker should not handle broken sharp objects or broken glass by hand. Use of tongs, forceps, tweezers, magnets or other devices to pick up and discard the broken object is advisable.
2. While disinfecting contaminated areas or equipment workers should wear protective gloves such as latex or other watertight gloves, safety glasses or goggles and cleansing wipes.
3. If work surfaces or equipment have come in contact with blood or other body fluids for example, a worker's finger has been cut and has bled onto the equipment surface; these surfaces should be cleaned and disinfected immediately. Medical attention must be provided to the concerned worker.
4. All the areas such as walls, floors and doors of the work areas should be wiped with clean and sterile sponges and mops. Care should be taken to wet the sponges and mops with sterile disinfectant solution in proper concentration.
5. All exposed surfaces of equipment and glass panels should be sprayed and wiped with sterile solutions. Spillage or leaks if any should be cleaned and mopped immediately using sponge and sterile disinfectant solution.

Good Housekeeping Practices

Efficient production and good working environment are complimentary and go hand in hand for achieving organizational goals. A clean, orderly and attractive environment encourages tidy work habits in employees and also boosts their efficiency. Good housekeeping is more than just the cleanliness. It also involves minimizing risks which may cause accidents and hazards. Good housekeeping is mandatory in every phase of industrial operations. Indoor areas such as work area, reception, washrooms etc. as well as outdoor areas such as lounge, parking lot, garden etc. should be maintained and governed by housekeeping practices as followed in the organization:
Poor housekeeping leads to a sense of chaos, accidents and also gives rise to:

- Excessive clutter of material and waste material in the working area
- Congested aisles
- Tools left on machines, which may be misplaced or lost

- overflowing waste bins, causing unhygienic conditions
- Lockers and workrooms in disorder that may lead to various infections
- Chemicals and Acids in open containers, that may be hazardous
- Broken glass, that may be dangerous and can cause serious injuries
- Open electric wires or air lines across aisles that may be fatal
- Unclean light fittings, windows and skylights, it may cause darkness in the room.
- Accumulated piles of paper and other packing materials, which may hide some important and useful tools.
- Infestation by pests such as rodents and cockroaches

Benefits of Good Housekeeping Practices:

Housekeeping refers to cleaning and organizing a place as well as minimizing risks, accidents and hazards due to unkempt and untidy premises such as loose and dangling wires, overflowing bins and containers, slippery floors etc. Good housekeeping practices help in keeping the premises clean, systematic and hazard free and thus boost the efficiency and productivity of employees.

Some Good Housekeeping Practices:

1. **Regular cleaning and maintenance:** Housekeeping should not be restricted to only few occasions such as inspections and audits, meetings etc. In fact, the entire premises should be cleaned and maintained regularly and frequently.

2. **Repair and check of all electrical switches, wiring and supply:** All power supplies and electrical wiring and switches also fall under housekeeping and should be checked and maintained regularly with utmost sincerity.

3. **Aisles:** Aisles should have clearly marked floor lines to keep them segregated for work areas and storage areas. Also, these should not have any debris, scrap or boxes stacked in their way.

4. **Floors and walls:** These should be clean and free from dust, dirt and marked clearly with signboards and placards wherever necessary. Spilt oil and other liquids should be cleaned up at once. Walls with chips, shavings, and floors with dust, and similar wastes should never be allowed to accumulate. They should be cleaned frequently.

5. **Well-maintained amenities:**Facilities or amenities such as washrooms and lockers for clothing should be clean and keep up to date. Lunchroom should be clean, well-maintained and inviting.

6. **Waste removal:** There should be a proper waste disposal schedule along with cleaning agents and equipment. There should be adequate facilities to prevent congestion and disorder in the premises.

7. **Maintenance of light fittings:** A good housekeeping programme will pay attention to light fittings, its care and maintenance in the premises. It must be an integral part of such a programme. Lamp shades and lights become dirty with use and often accumulate dirt and dust around them. This reduces their efficiency and the workers are devoid of essential light which puts strain on their eyes. Simple cleaning of lamps/bulbs reflectors and tube lights is known to improve the lighting efficiency.

8. **Cleaning of the windows:** Clean window glass help in optimizing the availability of day light and dirty ones keep it out. Improper lighting arrangements at the workstation can lead to eye strain and accidents because of low visibility. Efficient housekeeping ensures that windows are not blocked by stacked materials, equipment or articles on the ledges and are dust free.

9. **Ventilation:** There should be adequate ventilation in the premises. The ventilators and exhaust fans should be clean and free from dust, cobwebs, grease etc.

10. **Fully functional first aid gear:** First aid facilities and equipment should be kept under spotlessly clean conditions and fully stocked so that they are always ready in the event of accidents or illness.

11. **Inspection of fire extinguishing equipment:** Regular inspection of all fire-fighting equipment such as extinguishers and fire hoses are vital for keeping them in good working condition. Fire protection facilities such as door and exits, automatic alarms, smoke detectors etc. must be in excellent working condition. Care should be taken to check and avoid any jammed or blocked fire exits and doors. Doors and exits should always be kept clear of obstructions.

Hazards of Poor Housekeeping Practices:

Regular and timely housekeeping has many benefits. However, housekeeping is not practiced regularly and efficiently it may pose serious problems. Some of the hazards and problems associated with poor and irregular housekeeping practices are:

- Untidy and unsafe premises
- Accidents
- Fire Hazards
- Chemical and oil spillage
- Dusty walls and windows
- Slippery floors and handles
- Jammed doors and knobs
- Unkempt, smelly washrooms and change rooms etc.
- Falling and tripping over objects lying on floors, stairs and platforms
- Accidents due to falling objects
- Wet or dirty surfaces causing slipping and falls
- Striking against items kept in undesignated or wrong locations or items piled up in stacks near aisles and exits
- Projecting nails, wire or steel rods which may cause injuries such as piercing any body part, tearing skin etc.
- All this leads to a direct bearing on the efficiency and productivity of employees and may bring down their morale too.

Activies

Prepare a chart/graphic poster on importance of personal hygiene.

Material Required:

1. Chart Sheet
2. Colourful Pens & pencils
3. Pencil
4. Eraser
5. Ruler

Procedure:

1. Collect all the required information.
2. Prepare your chart and get it verified by your teacher.
3. Finish it.
4. Attach the chart on the drawing board of the classroom.

Prepare a skit on various hazards of poor housekeeping practices and enact it in your class. Also conduct a discussion on the same.

Procedure:

1. Plan your skit on any situation related to hazards of poor housekeeping practices.
2. Distribute dialogue and roles among all the participants.
3. Enact the skit in your class.

Check Your Progress

Fill in the Blanks

1. _____ is important mainly because it saves us from illnesses and ensures good health.
2. Hands must be washed on regular intervals with an effective _____.
3. Benefits of a healthy lifestyle are increased concentration, sharp memory and it also gives an _____.
4. Performance of a worker is directly related to the _____ of the worker.
5. _____ leads to a sense of chaos and accidents.

Question Answers

1. Explain Personal hygiene and its importance in a workplace.
2. Describe Safe Working Practices and Organizational Procedures.
3. Discuss Good Housekeeping Practices.

Session3: Environmental management Procedures, Security Details, Potential Accidents and Emergencies

Every organization has an Environmental Management System (EMS) that helps it in achieving its environmental goals. This is done through consistent reviewing, evaluation, and improvement of its environmental performance. This approach reduces the risk of non-compliance and improves health and safety practices of the workers. Basic procedures followed under EMS are as follows:

- Review of the environmental goals of the organization.
- Analyzing its environmental impacts and legal requirements.
- Setting targets for reduction of harmful impacts on environment and comply with legal requirements.
- Introducing and implementing programme to meet these objectives and targets.
- Monitoring and measuring progress in achieving the objectives.
- Ensuring employees' environmental awareness and competence.
- Reviewing progress of the EMS and making necessary improvements.

Potential Benefits of implementing EMS-

- Improved environmental performance.
- Enhanced compliance
- Pollution prevention
- Resource conservation
- Increased efficiency leads to reduced costs.
- Enhanced morale of workers
- Enhanced image with public, regulators, lenders and investors.
- Employee awareness of environmental issues and responsibilities.

Layout of the plant and details of emergency exits/routes, emergency equipment and assembly points

Plant layout is the most effective physical arrangements of machines, processing equipment and service departments. A good plant layout helps in achieving proper coordination of men, materials and machines. The adequacy of layout affects the

efficiency of daily operations in any company/organization. A plant layout involves the allocation of space and the arrangements of equipment in such a manner that overall operating costs are minimized. Plant layout is planning the path each component/part of the product is to follow through the plant.

Plant layout also affects the security and stability of the company. While deciding the layout of the plant and allocating space for various machines and operations, security should never be compromised. It should utilize the space most effectively while maintaining the security of the men, machines and the premises. It should provide workers convenience; promote job satisfaction and safety for them. A well-designed plant layout helps in achieving the following objectives.

- Proper utilization of available floor space.
- Ease of transportation.
- Efficient utilization of production capacity.
- Reduction in material handling cost.
- Reduction in number of accidents.
- Provide ease of supervision and control.
- Ensures employee safety and health.

Plant layout ensures the following measures of safety at the workplace

- Firefighting equipment list and its placement.
- Fire safety plan for evacuation in case of emergency.
- Emergency evacuation diagrams (details of emergency escape/exit routes).
- Assembly points at the time of emergency.
- Appropriate placement of machineries.
- Allocation of proper space for waste disposal.
- Proper placement of First Aid Boxes in case of medical emergencies.
- Allocation of proper space for drinking water and sanitization facilities.

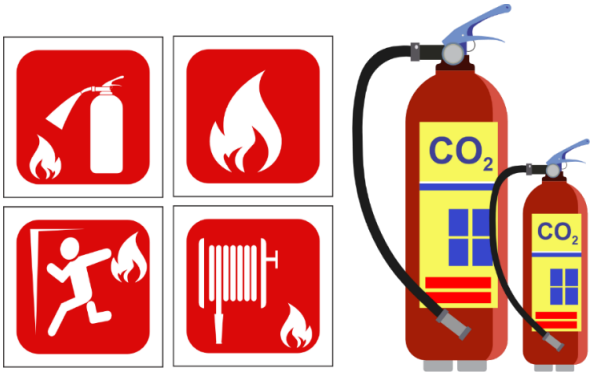


Fig. 6.8: Fire Extinguishers symbol and equipment

Potential accidents, emergencies and response:

Emergencies or disasters are not at all welcome in any organization as they effect the health and life of employees and in turn also effect the business. However, the truth is that despite all the precautions and safety measures, emergencies and disaster can occur anytime and anywhere. Sometimes these emergencies and disaster occur at a time when they are least expected. At such difficult times the corrective measures are necessary to overcome such situations.

An incident/potential accident that can occur during the process of production or services if left un-attended can lead to injuries, complication leading to disability, death, or prolonged hospital stay for a worker.

Awareness of incidents at workplaces is a key factor in preventing them at yours. Following are some of the most common causes of accidents at the workplace:

1) Heavy Lifting
2) Fatigue
3) Dehydration
4) Poor Lighting
5) Hazardous Materials
6) Fire Accidents
7) Acts of Workplace Violence
8) Trips and fall
9) Stress
10) Explosions
11) Chemical spills
12) Heat Waves

The best way is to prepare ourselves to respond to an emergency before it happens. Few people can think clearly and logically in a crisis, so it is important to do so in advance, when we have time to prevent any crisis as rightly said “prevention is better than cure”. Industries also run mocks or drills to train people/workers about what to do and how to act in case of emergencies.

Emergency Response Plan

The initial minutes of an emergency are very critical and require immediate action. Promptness in announcing warnings and instructions to employees for evacuation, shelter or lockdown can save their lives. Public emergency services such as police,

fire department, hospitals should also be called for immediate action. All employees must be trained in first aid, emergency evacuation, fire drills etc.

Proper risk assessment should be done for developing an emergency response plan for this all potential emergency scenario should be clearly identified. An understanding of potential emergency scenarios can also help us to plan an arrange all resources and procedures required to prevent them in the first place. The emergency plan should be consistent with our performance objectives.

Development and implementation of an emergency plan is vital for every industry. This is specially required for protection of all the employees, visitors, contractors and anyone else visiting and working in the organization. This emergency plan also includes building evacuation through fire drills, sheltering practice from severe weather such as lighting, floods etc. There should also be a provision for shelter - in - place from air borne hazards such as a chemical release. Safety of life should always be the first priority is case of emergencies. Stabilization of the incident and normalization of the situation should be the second priority. Employees should be aware of the action that should be taken to stabilize untoward incident.

For example - Employees should be trained to use the fire extinguisher efficiently for controlling small fire accidents. Containment of a small chemical spill and supervision of building utilities and systems can minimize damage to a building and can help prevent any environmental damage. A plan should be well established and resources should be on hand, or quickly available as response to any potential accident or emergency.

Different type of signboards at workplace and their application:

Safety signboards are essential components within the handicraft sector, serving as visual cues to communicate crucial information regarding potential hazards, safe practices, and emergency procedures. These signboards play a pivotal role in maintaining a safe and secure working environment for employees, reducing the risk of accidents and injuries. Here's an overview of safety signboards commonly used in the apparel industry:

Caution Signs: Caution signs are used to warn employees about potential hazards that may not result in serious injury or death but can still cause harm. In the apparel industry, caution signs might indicate areas where there's a risk of tripping, slipping, or falling. These signs are usually depicted using a yellow background with black text and symbols.

Fig. 6.9: Sign of Caution

Danger Signs: Danger signs are used to indicate situations that could result in serious injury or death. In the context of the apparel industry, danger signs might be used to mark areas with heavy machinery, high-voltage equipment, or other life-threatening risks. These signs typically feature a red background, white text, and a bold, easily recognizable symbol.

Fig. 6.10: Sign of Danger

Emergency Exit Signs: These signs are crucial for indicating the locations of emergency exits and evacuation routes. In the handicraft industry, where factories can be large and complex, these signs guide employees to safety during emergencies like fires or other crises. They usually feature a green background with white text and a pictogram of a person exiting a door.

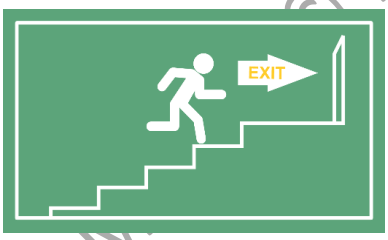


Fig. 6.11: Sign of Emergency Exit

Fire Safety Signs: Fire safety signs convey information about the location of fire extinguishers, fire alarms, and fire assembly points. These signs help employees respond quickly and appropriately in case of a fire emergency. Fire safety signs are often red or green, with white text and symbols.

Fig. 6.12: Sign of Fire Safety

Personal Protective Equipment (PPE) Signs: PPE signs remind employees to wear appropriate protective gear when entering specific areas. In the handicraft industry, where there might be exposure to chemicals, heat, or noise, these signs play a crucial role in preventing injuries and maintaining workplace safety.

Fig. 6.13: Sign of Personal Protective Equipment

Chemical Hazard Signs: For apparel factories that handle chemicals for dyeing, printing, or other processes, chemical hazard signs inform workers about the potential risks associated with specific substances. These signs use recognizable symbols and color codes to indicate the type and severity of the hazard.

Fig. 6.14: Sign of Chemical Hazard

First Aid Signs: First aid signs indicate the location of first aid kits and medical facilities within the workplace. These signs ensure that employees can quickly access necessary medical supplies in the event of an injury.

Fig. 6.15: Sign of First Aid Kit

Restricted Area Signs: These signs are used to restrict access to certain areas that pose a danger to unauthorized personnel. In the handicraft industry, restricted areas might include machine rooms, storage areas with heavy loads, or areas with ongoing maintenance work.

Fig. 6.16: Sign of Restricted Area

Machine Safety Signs: These signs are placed on machines to provide instructions on safe usage, maintenance, and proper procedures. They help prevent accidents caused by incorrect operation or lack of awareness.

Fig. 6.17: Sign of Mechanical Hazards

Training and Safety Awareness Signs: These signs serve as reminders for employees to undergo regular safety training and maintain awareness of safety protocols. They encourage a safety-conscious mindset among workers.

In the handicraft industry, safety signboards serve as an integral part of the overall safety management system. They help prevent accidents, reduce downtime due to injuries, and promote a culture of safety among employees. It's important for these

signboards to be clearly visible, easy to understand, and regularly maintained to ensure their effectiveness in promoting workplace safety.

Fig. 6.18: (a), (b) and (c) Warning Signs

Following table shows some types of hazards at workplace and the related safety measures which should be taken care of:

Hazards	**Safety Measures**
Spreading and Cutting	
Finger and hand injuries from spreading machines	Wear gloves and handle paper tags mindfully.

Finger and hand injury from moving or idle cutting devices	Ensure that the finger guard is adjusted to the correct height of the carton to be cut. Learn and use the correct handling techniques for the tool.
Finger and handing injury package lifting area.	Ensure that the two-handed control system is functioning properly. A light sensor should stop the machines when the working area is transgressed
Finger and hand injury in the press	Safety guards should be checked daily for correct operation
Burns from hot beds	Never attempt to retrieve, or adjust the position of components whilst they are being fed, or are on the bed
Finger and hands injury in feeding and unloading	A press which has to be controlled using both hands must be operated by the one person. Operators must be well trained and practiced in laying the parts on the feeding belt conveyor
Finger and hand injury during cleaning and repair work	The machine must be switched off, with plug removed and must be stationary before any cleaning or repair work is started
Finder injury from the needle	Correct setting of the finger guard should be checked before work starts
Pulled hair and face injury from the yarn feeder	Long hair should be gathered and pinned up or a hairnet should be worn. A safety guard should be provided for the yarn feeder
Hand and finger injury from fastening devices on hook, eyelet and rivet machines.	Correct setting of the safety guards should be checked. Training must be given in the correct handling techniques for holding and feeding materials
Eye injury from breaking needles or buttons at the button sewer, or breaking needles at the loop sewer	Proper adjustment of eye shield should be checked before work starts. Cracked or obscured shields should be replaced, or safety glasses should be issued.
Contact with Scissors and Needles	

Cuts and pricks from sharp points	Sharp pointed scissors should not be left unprotected. They should be kept in special holders (leather holsters cases) carried e.g. on a belt and stowed away properly after use.
Internal injury from swallowed items	Never store items temporarily in the mouth. There is a danger of swallowing them as a result of coughing sneezing or being startled. Place needles in the proper container or in a needle cushion.
Burns from hand irons	Hand irons should be protected from overheating by a thermostat. Non-flammable material should be used for the working area.
Finger and hand injury from the press	A machine which requires two hands to operate it must never be operated by two people never attempt to adjust the position of parts after the closing process has started a safety bar must be fitted which stops and raises the head when it is touched
Inhalation of solvent vapors, skin damage or reaction to contact with solvents	Ensure adequate ventilation, only the equipment in materials actually required for a given working shift should be present
Fire hazard	An adequate distance must be maintained at least 5 meters from any potential ignition source.
Hazardous chemicals	Safety warning instructions on the container should be observed and appropriate working method adopted
Head injury from overhead transport systems with suspended carriers	Head protection (padded hard hats) should be provided with the transporter rails pass over a walkway the floor should be marked with black and yellow warning strips
Trapped fingers when maneuvering careers over points	Safety guards should be fitted and proper training in handling method should be given

Falling from raised service platform and access points	Safety guards have to be in place. Specialized equipment should be used for servicing trolleys and proper handling procedures observed
Hand and finger injury from conveyors	Equipment must be guarded, and the safety guards must never be removed
Accidental injuries from tripping over the feet of movable hanger stands	Movable hanger stand should be found only in designated areas. They should not encroach on to marked walkways

Activies

Prepare a detailed report on personnel trained in first aid, firefighting and emergency response.

Materials Required:

1. Practical File
2. Coloured pens and pencils
3. Ruler
4. Eraser

Procedure:

1. Visit a craft cluster.
2. Prepare a questionnaire.
3. Interview people trained for emergency services.
4. Document it and prepare a detailed report of the same.

Check Your Progress

Fill in the Blanks

1. Every organization has an _____ that helps it in achieving its environmental goals.
2. A good plant layout helps in achieving proper coordination of men, materials and_____.

3. _____are used to warn employees about potential hazards that may not result in serious injury or death but can still cause harm.
4. Fire safety signs convey information about the location of_____, fire alarms, and fire assembly points.
5. Restricted areas might include_____, storage areas with heavy loads, or areas with ongoing maintenance work.

Question Answers

1. Explain any two types of Signboards that are used (with diagrams)
2. Describe health and safety measures taken in a garment industry.
3. State some potential benefits of implementing EMS.
4. Write in your own words how would your response to an accident or emergency of fire breakout in a corner of the finishing and packing department.

ANSWER KEY

MODULE – 1

SESSION: 1

True Or False

1. True
2. True
3. True
4. True
5. False

Fill in the Blanks

1. Silk
2. Environmental
3. Resistance
4. Elasticity
5. Cotton, Silk

SESSION: 2

True Or False

1. True
2. True
3. True
4. False
5. True

Fill in the Blanks

1. Irregular
2. Twisting
3. Cost-cutting
4. Parameters
5. Proportional

SESSION: 3

True Or False

1. True

2. True
3. True
4. False
5. False

Fill in the Blanks

1. Hosiery
2. Yarn
3. Strength
4. Two
5. Selvedge

MODULE – 2

SESSION: 1

True Or False

1. False
2. True
3. False
4. True
5. False

Fill in the Blanks

1. 1.5 to 4.5 meters
2. 70%
3. White jute
4. Luster

SESSION: 2

Fill in the Blanks

1. Scouring
2. Direct, reactive, vat, and sulphur
3. Basic dyes
4. Jigger

True Or False

1. True
2. True
3. True

4. True
5. True

SESSION: 3

True Or False

1. True
2. False
3. True
4. True
5. False

Fill in the Blanks

1. Governments
2. Positive
3. Biodegradable
4. Extracted
5. Recycling

MODULE – 3

SESSION: 1

Fill in the Blanks

1. Golden
2. Rishra
3. Loom
4. Eco-friendly

True Or False

1. False
2. True
3. False
4. True

SESSION: 2

Fill in the Blanks

1. Technical textiles
2. Bangladesh/ Brazil/Philippines

3. Imports
4. Strength
5. Research

True Or False

1. True
2. False
3. False
4. False
5. False

SESSION: 3

Fill in the Blanks

1. 2005
2. West Bengal
3. Improved Cultivation and Retting Exercise

True Or False

1. False
2. False
3. False

MODULE – 4

SESSION: 1

Fill in the Blanks

1. Skilled
2. Jute
3. Creativity
4. Eco-friendly
5. Storage

SESSION: 2

Fill in the Blanks

1. Measuring tape
2. Scissors
3. Ball point

4. Glue gun, Glue stick
5. **Feeding**

True Or False

1. False
2. True
3. False
4. True

SESSION: 3

Fill in the Blanks

1. Design
2. Designing
3. Labelled
4. Modular

MODULE – 5

SESSION: 1

Fill in the Blanks

1. Personal protective equipment
2. Cleaning and maintenance
3. Gum boots
4. Ear muff or ear plugs

SESSION: 2

Fill in the Blanks

1. Inventory
2. Packing
3. Recycling
4. Regular maintenance
5. Sludge and wastewater
6. Waste disposal

SESSION: 3

Fill in the Blanks

1. Durability

2. Colour
3. Fatigue
4. Maintenance
5. Productivity

MODULE – 6

SESSION: 1

Fill in the Blanks

1. Hazard
2. Chemicals
3. Musculoskeletal disorders
4. Flammable materials
5. Machinery

SESSION: 2

Fill in the Blanks

1. Personal hygiene
2. Hand disinfectant liquid
3. Emotional boost
4. Health
5. Poor housekeeping

SESSION: 3

Fill in the Blanks

1. Environmental Management System (EMS)
2. Machines
3. Caution signs
4. Fire extinguishers
5. Machine rooms

List of Credits

Graphics

Verma Prachi – Fig. 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, 1.20, 2.3, 2.10, 2.16, 2.25, 2.26, 3.6, 3.7, 3.8, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.22, 4.23, 4.24, 4.25, 4.26, 4.27, 4.28, 4.36, 4.37, 4.39, 4.40, 4.41, 4.42, 5., 5.2, 5.3, 5.4, 5.5, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18

Photographs

Singh Raghuveer – Fig. 1.19, 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.11, 2.12, 2.13, 2.14, 2.15, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24, 3.1, 3.2, 3.3, 3.4, 3.5, 4.18, 4.19, 4.20, 4.21, 4.29, 4.30, 4.31, 4.32, 4.33, 4.34, 4.35, 4.38