

6. FABRIC CONSTRUCTION



Do you know

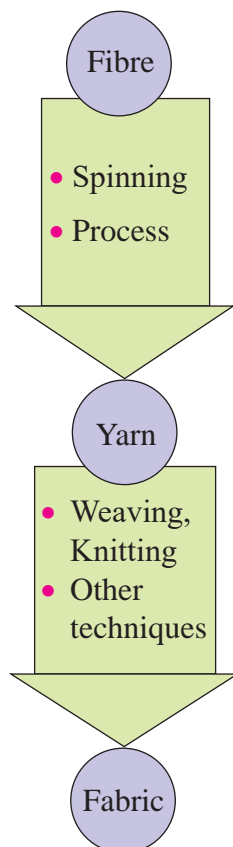
Do you know how fabrics are made from yarns?

Do you have any idea how many types of different fabrics can be made from the same yarns?

Can you tell in how many ways fabrics can be made?

Fabrics are made from yarns which are in turn made from fibres. Fabrics can be made in many different ways like Weaving, knitting, felting and braiding etc. The three fundamentals of textiles are as follows -

Chart No. 6.1 Sequence of Fabric Construction



- **Fibre:** is either spun into yarn or directly compressed into a fabric.

- **Yarn:** is woven, knitted or otherwise made into fabrics by spinning process.
- **Fabric:** is a finished consumer goods by various finishing processes.

6.1 Weaving

The most popular method of fabric construction is **Weaving**.

Weaving is interlacing of warp and weft yarns at right angles.

- **Warp yarns :** The lengthwise yarns in a woven fabric which runs parallel to the selvedge are called warp yarns. They are also known as “ENDS”.
- **Weft yarns:** The widthwise yarns in a woven fabric which runs across the selvedge are called weft yarns. They are also known as “PICKS”.
- **Selvedge:** The outer finished edge on both sides along the length of the fabric. There are always two selvedges in a fabric which run parallel to each other. The distance between the two selvedges is the width of the fabric. Selvedges protect the fabric and prevent it from raveling. There are different types of selvedge for different fabrics. Eg. Plain, fused, split and tape.

Weaving is done with the help of a machine called **Loom**.

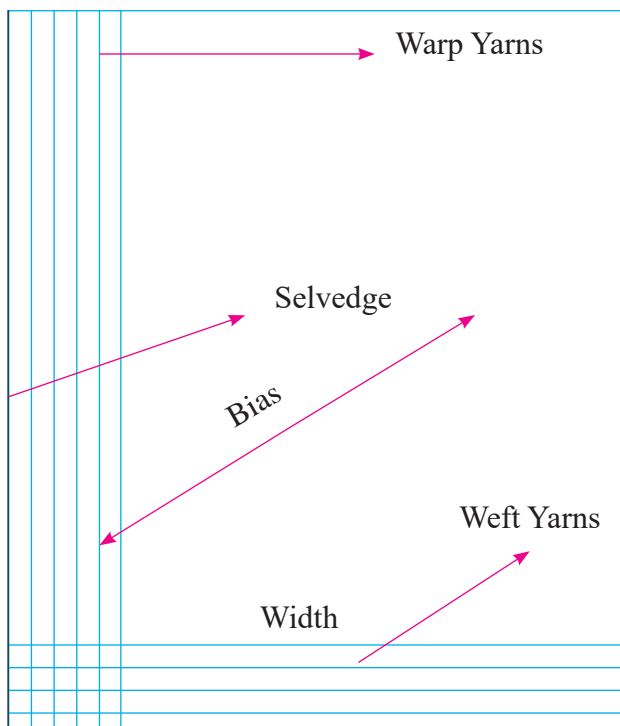
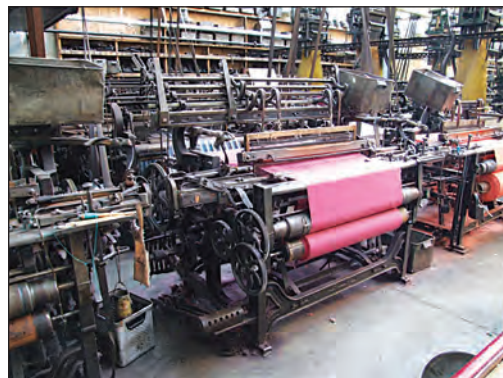


Fig No. 6.1 Woven Fabric



Pic. No. 6.2 Hand loom



Pic. No. 6.3 Power loom

A peek in history!

The knowledge of weaving was known to man even before spinning by observing the interlacement of grasses and twigs in bird's nest.

Initially crude looms were made from tree branches. Later for a long time simple handlooms were used for making fabrics all over the world. Power loom was invented in 1784 by **Edmund Cartwright**.

Indian traditional textiles about which you have studied last year, are still made on handlooms.

Different parts of a Loom:

- **Warp beam:** This is situated at the back of the loom and the warp yarns are wound over it and conveyed to the cloth beam.

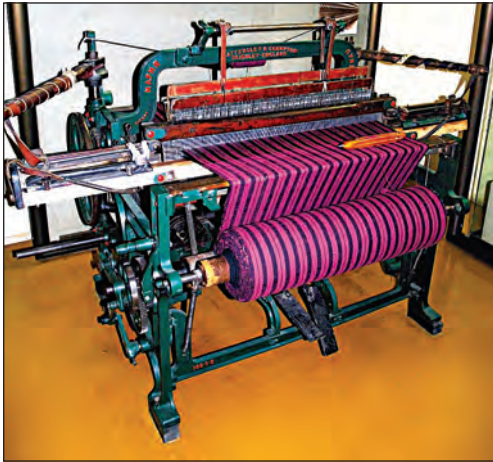


Pic. No. 6.4 Warp beam

- **Cloth beam:** This is situated at the front of the loom and the cloth that is woven is wound or rolled on this beam as it is constructed.

6.2 Basic structure of a Loom

Whether it is a handloom or a power loom, the basic parts and operations remain the same. Any loom will have at least the parts and operations discussed below.



Pic. No. 6.5 Cloth Beam

- **Harness:** It is a rectangle wooden frame inside which a series of wires are attached. These wires are called **Heddles**. Each heddle has a hole inside it which is known as Eye. The warp yarns while travelling from warp beam to cloth beam, pass through the eye of a heddle.



Pic. No. 6.6 Harness

- **Reed:-** This is a wooden frame that resembles a “Comb”. It has wires but there are no holes in them. The gap between the wires is called ‘**Dent**’. All the warp yarns pass through the dents. Function of reed is to push the newly inserted pick (weft) yarn towards the cloth constructed.



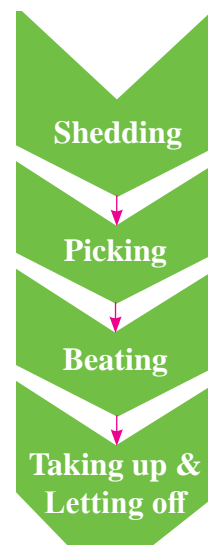
Pic. No. 6.7 Reed

- **Shuttle :** It is a small flat compass like instrument which carries the weft yarn. The weft yarn is wound on a spool and then the spool is fixed inside the shuttle. During weaving this shuttle passes from one side to the other side of the loom and inserts the weft yarn in the fabric.



Pic. No. 6.8 Shuttle

Chart No. 6.2 Four Operations (steps) of Weaving :



6.3 Operations of Weaving

- **Shedding:** Raising one or more harness to separate the warp yarns and form a gap between them through which the shuttle can pass. This gap is called **Shed**.
- **Picking:** Passing the shuttle through the shed to insert the filling (weft) yarns.
- **Beating or Battening:** Pushing the filling yarns firmly in the place in the woven cloth with the reed.
- **Taking up & Letting off:** Winding the finished fabric on the cloth beam and releasing more of the warp yarns from the warp beam.

Guess what!

When the loom is working, the first, second and third step are repeated a number of times till some length of the fabric is woven. Then the first three steps are suspended for a while and the fourth step is carried out. After that again the first three steps are done for a number of times.



Pic. No. 6.9 Weaver on the loom

Table No. 6.3 Difference between Warp and Weft Yarns

Warp Yarns		Weft Yarns	
1	They are lengthwise yarns in a woven fabric	1	They are widthwise yarns in a woven fabric.
2	They are comparatively stronger than weft yarns.	2	They are weaker than Warp yarn.
3	They are called Ends.	3	They are called Picks, Filling, short Woof.

6.4 Type of Weaves

The pattern in which the interlacement is done is called Weave. The repeat of the pattern is called a “weave repeat”.

Weave pattern can determine many characteristics of a fabric like-

Chart No. 6.4 Characteristics of Fabric affected by Weave Pattern

Appearance

Texture

Luster

Durability

Elasticity

Absorbency

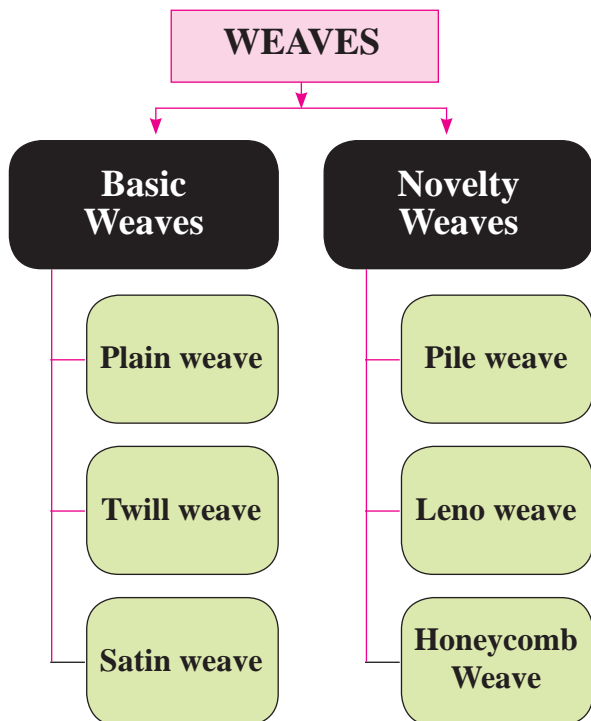
Drapability

Warmth

Weaves can be made in many different ways. Based on the way warp and weft yarns interlacement, weaves are classified into two broad categories, A) Basic weaves and B) Novelty waves.

- A) **Basic Weaves** : These are comparatively simpler weaves. They can be made on simple looms with limited number of harnesses. They are found in many of the fabrics of our daily use. The surface of the fabric is usually flat and smooth.

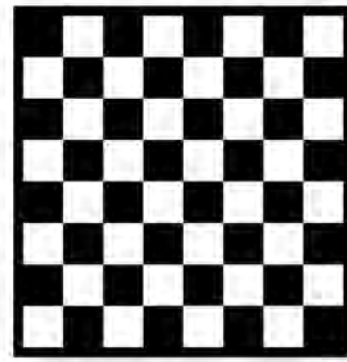
Chart No. 6.5 Types of Weaves



- **PLAIN WEAVE:** Also known as Simple weave or 1 up 1 down weave. The weft yarns and warp yarns go over and under each other alternately.

Characteristics of a plain weave:-

- Is the simplest of all weaves.
- Made on a simple loom.
- Requires only two harnesses.
- Weaving is alternately over and under one warp and weft yarns.
- Strong weave because interlacing of warp and weft is very high.
- Plain weave are reversible as they look alike from both sides.
- They are easy to clean less expensive, durable, uniform in construction.



Pic. No. 6.10 Plain Weave

Fabrics made of plain weave :

Long cloth, Gingham, Canvas, Chiffon, Georgette, Rubia, Muslin, Cambric, Organdy, Casement, Organza, Voile

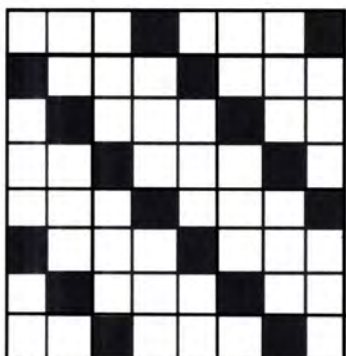
Variations of Plain Weave :

- **Rib weave:** Single warp yarn interlaces with multiple wefts or single weft yarn interlaces with multiple warp yarns. Length wise or width wise strips are seen on the surface of the fabric. Examples - Broad cloth, poplin
- **Basket weave:** Multiple warp yarns interlace with multiple weft yarns. Open block like design is seen on the surface of the fabric. Examples - Monks cloth, Shepherd Check.
- **TWILL WEAVE:** Diagonal lines are seen on the surface of the fabric.

Characteristics of a Twill weave:

- A prominent, distinct design of “diagonal lines” is formed on the surface of the fabric.
- The diagonal lines are visible on opposite sides of fabric too.
- The twill weave requires 3-8 harnesses.
- The twill weaves have good strength because the interlacing of warp and weft yarns is maximum.
- They are more complicated and expensive than plain weave fabric.

- They do not show dirt easily.
- They have good drapability, pliability and resiliency.



Pic. No. 6.11 Twill weave

Fabrics made of Twill weave :

Denim, Drill, Jeans, Gabardine,
Serge, Khaki, Flannel, Corkscrew,
Chino

Variations of twill weave:-

- **Even twill weave:-** When the filling yarns pass over and under the same number of warp yarns. It looks the same from both sides.
- **Uneven twill weave:-** When the filling yarns pass over either more or fewer warp yarns then go under, the weave is called uneven twill weave. It does not look same from both sides.



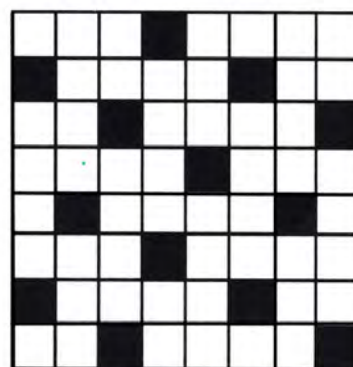
You Must Know ?

Twill weaves are also classified as right hand and left hand depending on the direction of the diagonal lines.

- **SATIN WEAVE:** The fabric is also known by the same name. The weave is made in such a way that the fabric looks extra lustrous and feels extra smooth.

Characteristics of a Satin weave:

- The extra luster and smoothness is because of the long “Floats” of warp yarns seen on the surface of the fabric.
- The weave uses basic construction of twill weave but it forms a broken diagonal lines.
- Satin weave uses 5-12 harnesses.
- Satin weave fabrics are relatively weak and less durable because the interlacing between warp and weft yarns is minimum.
- They have greater tendency to wear out by abrasion and snagging because of the longer floats.



Pic. No. 6.12 Satin weave

Fabrics made of Satin weave :

Dasmask, Slipper satin, Bridal satin,
Antique satin,
Venetian, Crepeback satin

Variation of Satin weave:

- **Sateen weave:-** In this long floats of weft yarns are seen on the surface of the fabric.



Do You Know ?

- ‘Floats’ are the length of the warp yarns between two wefts.
- Reflection of light on the floats gives lustre to fabric.

Can you tell why?

Satin weave fabrics are used for bridal gowns.

Internet my friends

Find out about more variations and examples of basic weaves.

B) Novelty Weaves:

Novelty weaves are formed by introducing changes in the interlacing patterns of warp and weft yarn. Novelty weaves are used to increase attractiveness, variety and to enhance beauty of the fabric. These weaves require some type of special attachments on or above the loom. The three novelty weaves discussed in this chapter are as follows -

- **PILE WEAVE:** This is a 3-dimensional weave. There are loops or piles seen on the surface of the fabric.
 - The pile is produced by weaving three sets of yarns, warp yarns, weft yarns and an additional wrap or weft yarn is the basic structure.
 - The additional yarn forms loops at regular intervals.
 - The pile weave fabrics create an effect of depth.
 - Pile weave fabrics give softness, warmth and absorbency.

Pile weave fabrics are of two types: -

- **Cut pile weave:** When the loops formed on the surface are cut or closely sheared. These piles or loops are cut with knife edges. Examples of Cut pile weave:- Velveteen, Corduroys and Velvet.



Pic. No. 6.13 Cut pile weave

- **Uncut pile weave:** When the loops formed on the surface are not cut, it is called Uncut pile weave. Uncut pile fabrics are soft and fluffy and the pile loops make the surface more absorbent. Examples:- Terry Towels, Carpets and Upholstery.



Pic. No. 6.14 Uncut pile weave

Table No. 6.6 Difference between Cut Pile & Uncut Pile Weave

Cut pile weave		Uncut pile weave	
1	Loops formed on the surface are cut or closely sheared.	1	Loops formed on the surface are not cut.
2	Cut loops appear only on one side of the fabric.	2	Loops appear on one or both sides of the fabric.
3	Cut loops may not catch and tear.	3	Loops may catch and tear.
4	Soft and beautiful.	4	Absorbent.
5	Eg. Velveteen	5	Eg. Terry Towel.

- **LENO-GUAZE WEAVE:** This is made in a totally different manner. The fabric has a lace like appearance with lots of open space.
 - Leno weave is also called guaze weave.
 - In this weave the warp yarns are in pairs, situated front and back. They keep on exchanging place as the fabric is made.

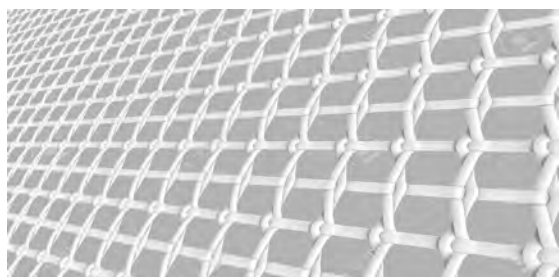
- The front one goes at the back and the back one comes to the front making a figure of 8 shape in between which a weft yarn is inserted.
- Each filling yarn is encircled by two warp yarns.
- This weave produces a decorative fabric which is durable, stable and has strength.



Do you know?

Leno weave is made with the help of a special attachment known as 'Doup'. This is a hair pin like device on the loom which moves both horizontally and vertically and controls warp yarns.

- Examples of Leno fabrics, Curtains and drapery fabrics, mosquito nets, laundry bags, food bags, shopping bags, mosquissette and grenadine.



Pic. No. 6.15 Leno weave

- **HONEYCOMB WEAVE:** This is again a special weave made with the help of a special attachment to the loom. It has an interesting surface.
 - This weave has cell like appearance.
 - This appearance is created by the floating warp and weft yarns which forms ridges and hollows.
 - The surface is not smooth but is quite absorbent and so quite often used as toweling material.

There are two types of honey comb:-

- **Ordinary honey comb:** In this weave cell-like effect is observed on both sides of the fabric.



Pic. No. 6.16 Honeycomb weave

- **Brighton honey Comb:** In this cell-like formation is only on one side of the fabric.

Examples of Honey-Comb weave:

Towels, bedcovers, blankets and quilts, dress materials and coat materials.

Internet my friends

Find out about other Novelty weaves and how they are used.

Table No:6.7 Difference between Basic weaves and Novelty weaves

Basic weave		Novelty Weave	
1	Formed by simple interlacing patterns.	1	Formed by introducing changes in the interlacing patterns.
2	Does not require special attachments on the loom.	2	Require some type of special attachments on the loom
3	Create simple effect in the fabric.	3	Create decorative effect in the fabric.
4	Examples- plain, twill, satin.	4	Examples-pile, leno, honey comb.

6.5 Non-woven Fabric Construction

Though weaving is the most common way of producing woven fabric. Many fabrics are made by other techniques like Knitting, Felting, Braiding and Web Formation etc.

6.5.1 Knitting: This is the second most popular method of fabric construction. It is the creation of fabrics by forming loops of the yarn. The interlocking and continuous formation of new loops produces knit fabric.

In the construction of knit fabric, two terms **Wales** and **Courses** are used.

Wales: Refers to a column of loops that run parallel to the length of the knitted fabrics.

Courses: Refers to a series of successive loops lying crosswise in the fabric.



Pic. No. 6.17 knitted fabric

Knitting can be done by hand or by machine. There are two types of knitting machines -

- **Weft knitting machine:-** This is a circular machine in which the fabric is produced in the shape of a tube. This process is comparatively slow.
- **Warp knitting machine:-** In this machine, fabric is produced flat with straight side edges just like hand knitting. This is much faster.

Characteristics of a knitted fabrics:-

- They are stretchy, elastic, porous and resilient.
- These fabrics are soft, light in weight and require minimum or no ironing.
- They allow freedom of movement without fabric deformation.
- They allow air circulation.

Can you tell?

Why knitted materials are very popular as Sportswear?

Examples of Knitted fabrics:-

- Winter wears, inner wears, sport wears, hosiery etc. home furnishing, household textiles and industrial purpose.

6.5.2 Felting: This is a special process where fibres are directly converted into fabric without undergoing the step of yarn making. In felting process, wool or fur fibers tend to mat or interlock when they are subjected to heat, moisture and pressure. This happens because of the scales present on the surface of wool fibres. They form a sheet like construction which is known '**Felt**' and so the process is called '**Felting**'.

Characteristics of felt fabric:

- Felt has no grain, does not fray or ravel. Because of this, it is possible to cut Felt fabric in any shape.
- Absorbs sound. Because of this it is used below table clothes and other places where sound needs to be curbed.
- It has no elasticity.

Examples of felt:

Hats, slippers, shoe insoles, table padding, home furnishing, industrial purpose like matting and felt boards.

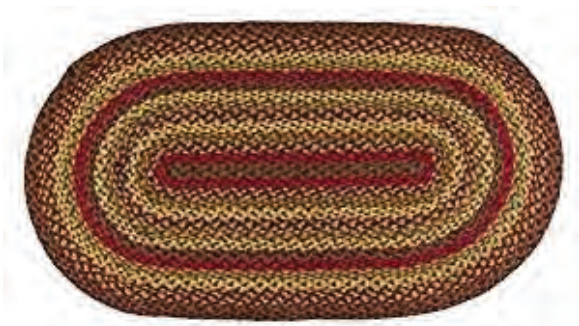


Pic. No. 6.18 Items made from Felt

6.5.3 Braiding: This is a process of interlocking or plaiting three or more yarns or strips of cloth, over and under one another to form a flat or tabular fabric. Braids are stretchy and easy shaping.

Examples of Braiding:

Braided fabrics are used for articles like straw, pads, small rugs, belts, narrow ribbons, necklace, shoe laces, wicks, fish lines, parachutes and glider cords and cables.



Pic. No. 6.19 Braided fabric items

6.5.4 Web formation: Web formation is a method to make fabric by construction of fibre webs. Fiber webs are produced by bonding or interlocking fibers by chemicals, mechanicals, thermal or solvent means. This is possible only with man-made fibres. They are cheaper and excellent choice for use and throw.

Examples of web-formed fabrics :

Diapers, sanitary napkins, surgical and industrial mask, bandages etc.



Pic. No. 6.20 Fibre web Items

Internet my friends

Find out more about other non-woven fabrics.



Use Your Brain Power

I. Who am I?

1. I am a machine which makes fabrics by interlacing of warp and weft yarns.
2. I make sheet like substance directly from woollen fibres.
3. I am the gap made between warp yarns in a loom..
4. The woven fabric is wound over me.
5. Heddles are fixed in my wooden frame.

II. Solve the Cross Word :

X	¹	X	²	X	X	³	X
X	⁴						
X		X		X	X		X
X		X		X	X		X
X	⁵				X		X
X	X	X	⁶				
X	⁷	X	X	⁸	X		X
⁹							X
X		X	X		X	X	X
X		X	X	¹⁰			X

Horizontal	Vertical
4. interlacing of warp & weft yarns	1. diagonal lines on the surface
5. weave that looks like net or lace	2. long floats of warp yarn
6. 1up 1 down weave	3. loops interlocking one another
9. matting of woolen fibres	7. comb like part of loom
10. hole in the middle of heddle	8. loops on the surface of fabric

EXERCISE

Objective Type Question

1. Match the following:

A		B	
1	Plain weave	A	Marquisette
2	Twill weave	B	Cell like
3	Leno weave	C	Battening
4	Reed	D	2 Harnesses
5	Pile weave	E	Denim
		F	Towels

2. Select and write the appropriate answer from the given alternative for each sub questions:-

- The length wise yarn in a woven fabric is _____.
a. Warp b. Weft c. Bias
- The basic characteristics of Twill weave is _____.
a. Diagonal lines b. Luster
c. Loops

- _____ is a novelty weave.

a. Plain weave b. Honey-comb
c. Satin

- The _____ is produced directly from the fibers.

a. Knit b. Lace c. Felt

- Weaving is done on a machine called _____.

a. Sewing machine b. Loom
c. Cording Machine

3. State whether the following sentences are true or false:-

- Warp yarns are stronger than weft yarns.
- Gauze bandage is a pile weave.
- There is only one harness in a loom.
- Fiber webs are made directly from fibers.
- Braiding is done on a doup loom.

4. Find the odd one out :

1. a. Felt b. Satin
e. Braiding f. Fibre web
g. Knitted fabric
2. a. Harness b. Reed
e. Shuttle d. Knitting needles
g. Warp beam
3. a. Voile b. Canvas
e. Khaki d. Gingham
g. Muslin
4. a. Terry cloth b. Velvet
e. Corduroy d. Sweater
g. Velveteen

Short Answer Type Question

5. Classify the following into given categories :

Woven construction Non-woven construction

Denim, Felt, Braiding, Satin

6. Give two examples of the following:-

1. Parts of the loom.
2. Plain weave fabrics.
3. The types of non-woven fabrics.
4. Twill weave fabrics.
5. Uses of fibre web.

7. Define the following terms:-

1. Weaving
2. Warp
3. Shedding
4. Felting
5. Knitting

7. Give Reasons:

1. Warp yarns are stronger than weft yarns.
2. Satin weave fabric are lustrous.

3. Pile weave is used for towels.
4. Twill weave is suitable for work cloths.
5. Fiber webs are cheaper than woven or knitted fabrics.

9. Answer in short :

1. What is a selvedge?
2. Write the characteristics of twill weave.
3. Write the uses of Felt.
4. Describe the pile fabrics.
5. Write the characteristics of knitted fabric.

10. Differentiate between:

1. Warp and Weft
2. Satin and Twill weave
3. Cut and uncut pile
4. Basic and novelty weave.

Long Answer Type Question

1. A) Types of weaves.
B) Describe the plain weave.
2. Explain the parts of Handloom?
3. Operations of weaving?
4. A) Describe any two Novelty weaves.
B) Give the basic characteristics of a novelty weave.

Project / Field Work

1. Visit a handloom industry and find out their difficulties and problems faced while weaving?
2. Collect the different types of fabrics and analyse their weaves.
3. Find out in how many ways we use non-woven fabrics in our life.

