UNIT-2: UNDERSTANDING FABRIC STRUCTURES

Fabric is the material that is used to make clothing or household articles.

The third successive stage in the making of a fabric is understanding the various methods of creating fabrics. Following are basic structures that are used to form fabrics which can be listed in the decreasing order of importance as:

Weaving (Interlacing)
Knitting (Interlooping)
Felting (Fiber Entanglement)
Decorative Fabric Constructions – Netting, Lace , Crochet, Braiding, Macramé

2.1 WOVEN FABRICS

You all must have seen the seat of a chair or a charpoy made with nylon or cotton. These are made with tape - when two sets of tapes are interlaced with each other at right angles. Similarly a fabric is also made by interlacing two sets of yarns at right angles.

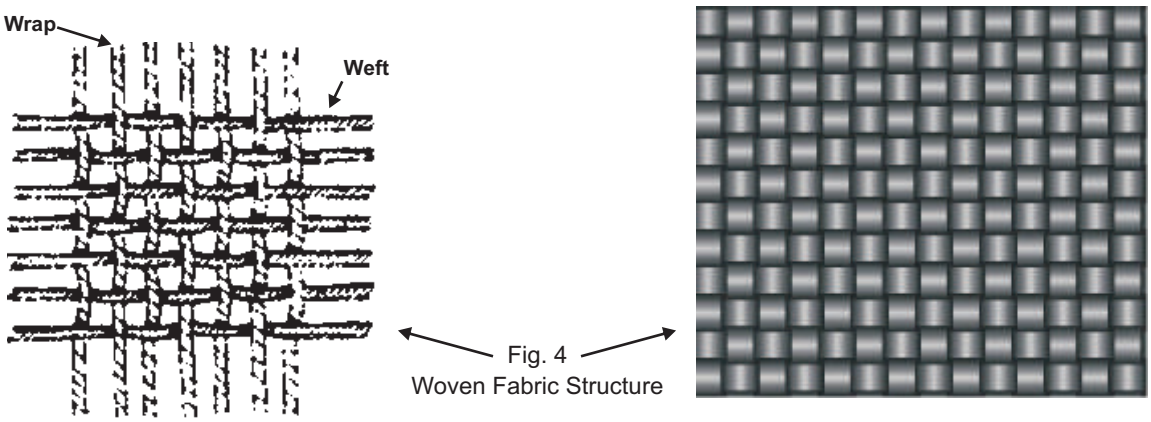


Fig. 4
Woven Fabric Structure

Woven fabrics are made by interlacing two sets of yarns at right angles to each other. The length wise yarns are called the **warp yarns / ends** and the width wise yarns are called the **weft yarns / filling / picks.** The lengthwise edges of the fabric are the selvages.

Grain indicates a direction parallel to either the warp or the weft. Direction i.e. 45 degree to both the warp and weft is termed as bias. The stretch is maximum along the direction of the bias. Woven fabrics have their best drape in the bias direction.

Fig. 5 Grain in a fabric

2.1.1 Making Woven Fabrics

The machine on which the fabric is woven is called a **loom.** The process of making the fabric on the loom is known as **Weaving.**

The loom:

a) The warp beam, located in the back of the loom is a large roller on which the warp yarns are wound. Re The number of yarns depends upon the pre-determined yarns per inch and the desired width of the final fabric. If the fabric is to have warp stripes, the colored yarns are tied as per the pattern of stripe desired on the fabric.

b) The warp yarns pass through the harnesses, that have many vertical wires called heddles, each with an eye in the middle. Each warp yarn is threaded through the eye of one heddle. The purpose of the harness is to lower or raise the warp yarns to create an opening or shed for passing the weft yarn. Minimum two harnesses are required in a loom and as the structure of the fabric design becomes complex, the number of harnesses are increased. In a simple loom all the odd numbers of yarns are attached to one harness and the even number of yarns are attached to the second harness. When the first harness is raised, the odd numbers of yarns are lifted to form a shed. This process is called shedding

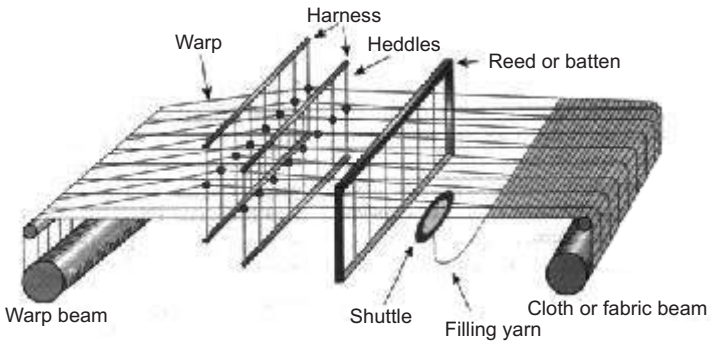


Fig.6 Weaving Loom

c) The weft yarn is inserted in this shed by using a boat shaped device called shuttle, which carries the yarn on a bobbin or pirn. In shuttle less looms the weft is inserted with other devices such as air or water jets. This process is called picking

d) The warp yarns, after passing through the harness pass through a reed. The reed is a frame with thin vertical wires and looks similar to a comb. Once the weft is inserted the reed is pulled by the weaver to make the fabric compact. This process is called beating up.

e) Finally the woven fabric is wound onto a cloth beam which is located in the front of the loom nearest to the weaver. This process is called take up.

2.1.2 Motions of the loom

The weaving sequence is a repetition of the following primary and secondary operations.

The primary operations are:

Shedding: the raising and lowering of the warp yarns by the harnesses to make an opening for the filling yarn to pass through

Picking: the process of inserting the weft in the shed

Beating: Pushing of the newly laid weft against the cloth

Secondary operations are:

Let Off: the slow unwinding of the warp beam to supply more warp yarn to be woven

Take Up: the woven fabric is wound up onto the cloth beam. The secondary processes i.e. take up and let off happen simultaneously.

2.1.3 Basic Weaves

There are many types of weaves used to make different kinds of fabrics like cambric, poplin, matt, satin, velvet, towels, denims, etc. There are three basic weaves. They are Plain weave, Twill weave and Satin weave. All other weaves are a variation or a combination of these weaves.

Plain Weave

It is the simplest and the most used weave. In this case, the warp and weft yarns alternate with each other, i.e. each weft yarn goes over one warp yarn and under the next warp yarn. Fabrics with plain weave are reversible unless one side is made the face by finishing or printing.

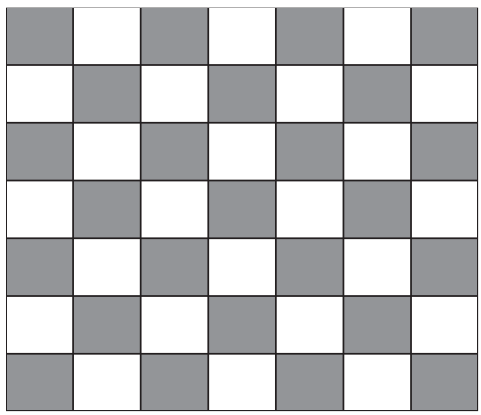


Fig. 7 Plain Weave Construction

Important Features:

Fabrics with plain weave have firm constructions, tend to wear well and ravel less than comparable fabrics with other weaves. Since the surface is plain it offers good background for printed or embossed designs, but the fabrics tend to wrinkle more than fabrics of other weaves. However the fabrics possess no surface interest unless colored yarns are used.

Basket Weave

It is a variation of plain weave. Basket weave is made by having groups of two or more warp yarns interlaced in plain weave pattern

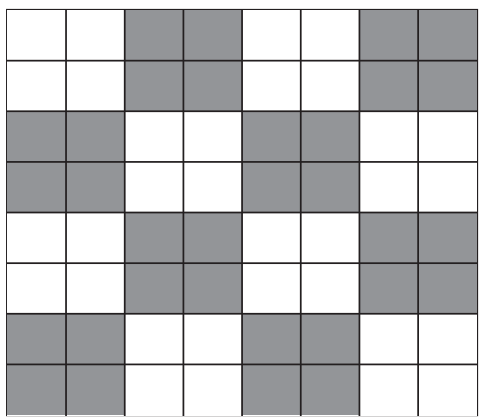


Fig. 8 2 x 2 Basket weave

Important Features:

Basket weave is a decorative weave and is made with relatively low yarns per inch and low twist yarns to increase the weave effect. These fabrics are not very stable since the yarns can move easily

Rib weave

It is usually made by using several yarns as one or a thick yarn in either the warp or weft direction to produce the rib effect. The interlacing is in the plain weave pattern.

Important Features:

The fabrics with rib weave are reversible unless one side is made the face by finishing or printing.

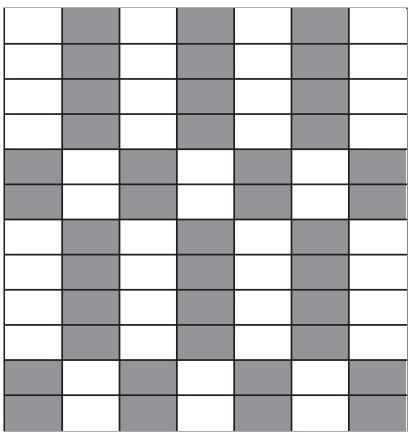


Fig. 9 Warp Rib Weave

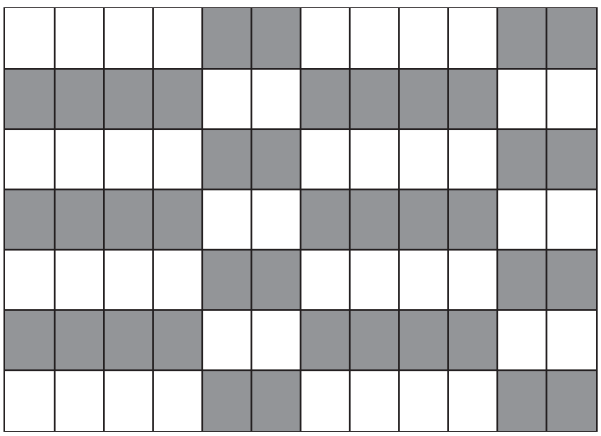


Fig. 10 Weft Rib Weave

Twill Weave

Twill weave produces a diagonal line on the face or the back of the fabric. The direction of the twill can be varied to create interesting effects such as broken twill, herringbone twill, pointed twill etc. Fabrics made by this weave are characterized by high strength and compact weaving.

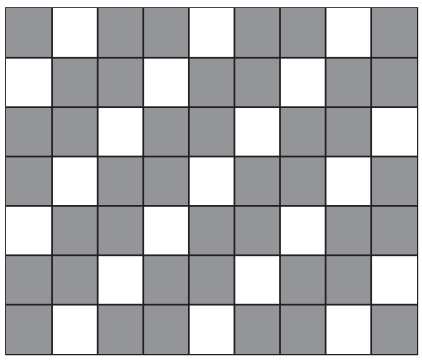


Fig. 11 Twill Weave

Important Features:

As the fabric exhibits high strength twills are widely used for work clothes and suiting fabrics

Satin Weave

Satin weave is characterized by a smooth, shiny and slippery surface created as a result of long floats present on its structure. As a result the warp yarns are seen more on the surface of the fabric. Reflection of light from these yarns give a shine to the fabric. Satin weave requires 5 to 12 harnesses. Moreover, the yarns used for making this weave have lesser twist as compared to the yarns used for other weaves. All these together give the fabric a soft, smooth and shiny appear.

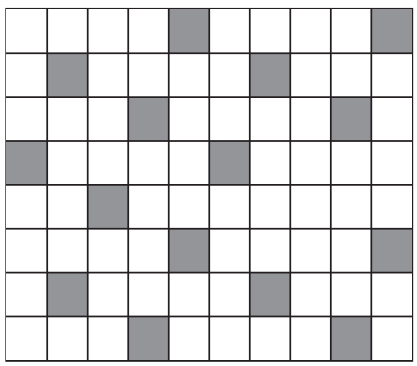


Fig. 12 Satin Weave

Important features:

Satin weave produces a very even surface because of the many warp or weft floats. However, the fabric has a poor wearing quality due to the less interlacements

2.2 KNITTED FABRICS

Knitted fabrics are described as structures produced by the interloping of yarns. Knitting has been a traditional method of producing items such as sweaters, underwear, hosiery and baby blankets. A single yarn or several yarns may be used to for the loops. Loops are formed, and then new loops are drawn through the previously formed loops. The continuous addition of new loops creates the knitted fabric. Apart from using hand knitting needles, commercially knitted fabrics are constructed on knitting machines.

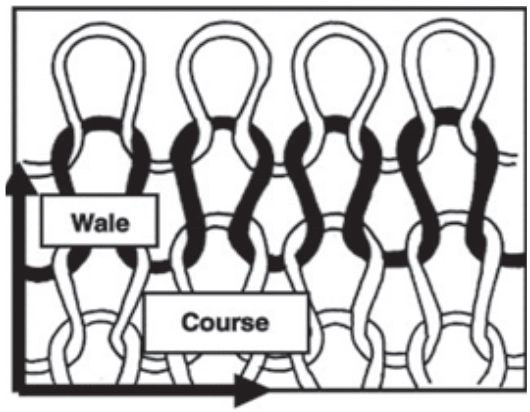


Fig. 13 Knitted Fabric

Basic terms used to describe knits are:

Wale: Vertical column of loops. These can be compared to the warp yarns of the woven

Courses: horizontal row of loops. These can be compared to the weft yarns of the woven.

Stitch: each single loop is called a stitch

Count: Total number of wales and courses per square inch of knitted fabric

Gauge: fineness of the fabric given by the number of stitches/ needles per unit width of the machine

2.2.1 Types of Knits

Knitted fabrics can be classified into two broad categories - Weft Knits and Warp knits

Weft Knits

Is a type of knitting in which yarns run horizontally from side to side across the width of the fabric. Hand knitting is a weft knitting procedure. All stiches in a course are formed by one yarn. Weft knits are made as either flat or open width fabrics (like woven fabrics) on Flat bed knitting machines, or as tubular fabrics (like seamless vests or socks) on circular knitting machines

Warp Knits

It is used for making flat width fabrics. Warp knitting produces a vertical loop structure. The yarns form a vertical loop in one course and then move diagonally to the next wale to make a loop in the following course. The yarns zigzag from side to side along the length of the fabric. Each stitch in a course is made by a different yarn. There is usually one yarn for each knitting

needle. The warp knits produce fabrics such as tricot, raschel etc. Jacquard attachment can also be used to create variations.

2.2.2 Common Knit Fabrics

Jersey: is also known as single knit. Fabrics of this type have all loops drawn to one side of the fabric and are most easily recognized by the fact that the smooth side is the face and the back has textured or mottled appearance. It has low stretch in the width and curls at the edges

Rib knits: they have lengthwise ribs alternating on the face and back. To identify rib knit fabrics it may be necessary to stretch the fabric width wise. The appearance of alternating columns of plain stitches in the lengthwise direction is evidence of a rib knit. Rib knit lie flat and do not curl like the jersey knits. Rib knits have greater elasticity in the width than the length and are often utilized for cuffs, neck lines, collars, sweater bottoms etc.

Interlock: it is a variation of rib knits and appears like two fabrics knitted back to back. These fabrics have low stretch, better shape retention and are easier to cut and sew.

Jacquard knits: they have intricate pattern and design similar to the woven jacquards

Pique: it resembles a miniature honeycomb pattern and is usually seen in sportswear.

2.3 NON WOVEN FABRICS AND FELTING (ENTANGLED FABRICS)

The art of producing fabrics directly from fibers matted together began before spinning and weaving were invented. Felting is the process of making fabric by the entanglement of fibers in the presence of heat, pressure and moisture.

Non-woven fabrics are adhesive bonded fabrics, in which the fibers are held together by a binder such as synthetic rubber, heat bonded fabrics using a mixture of manmade fibers with different melting points and needle punched fabrics, in which the fibers have been entangled by barded needles.

All these non-woven fabrics have special uses such as interlinings and stiffeners for garments, disposable diapers or nappies, tea bags, bandages, hats, filters and carpets.

2.4 DECORATIVE FABRIC CONSTRUCTION

Netting: is an open mesh form of fabric construction that is held together by knots or fused thermoplastic yarns at each point where the yarns cross each other.

Lace: is a derivative of netting. The technique of lace making involve looping, knotting, braiding, twisting or stitching thread into decorative open work patterns.

Crochet: is a simple form of warp knitting, usually done by hand. Basic fabric is made by forming a row of stitches with a length equal to the fabric width and then returning along the chain making double crochet stitches by inserting the needle into previous loops. The technique can create solid fabric or open lace like fabric.

Braiding: is a simple form of narrow fabric construction. The braid is created from a number of interlacing yarns. Braiding is used to create tubular structures such as hose pipes, shoe laces, cords or ropes. The simplest form of braiding is the plaiting of three strands.

Macramé: is created through a technique of knotting, macramé differs from other laces in texture and appearance. It is generally made of heavy yarn knotted into relatively large designs.

SUMMARY

Fabric is the material that is used to make clothing or household articles. **Woven fabrics** are made by interlacing two sets of yarns at right angles to each other. The length wise yarns are called the **warp yarns/ ends** and the width wise yarns are called the **weft yarns / filling / picks.** The lengthwise edges of the fabric are the selvages. The machine on which the fabric is woven is called a loom. The process of making the fabric on the loom is known as **Weaving.**

There are many types of weaves used to make different kinds of fabrics like cambric, poplin, matt, satin, velvet, towels, denims, etc. There are three basic weaves. They are Plain weave, Twill weave and Satin weave. All other weaves are a variation or a combination of these weaves.

Knitted fabrics are described as structures produced by the interloping of yarns. Knitting has been a traditional method of producing items such as sweaters, underwear, hosiery and baby blankets. Knitted fabrics can be classified into two broad categories, **Weft Knits and Warp knits.**

Some of the common knit fabrics are jersy knit, rib knit, interlock, jacquard and pique.

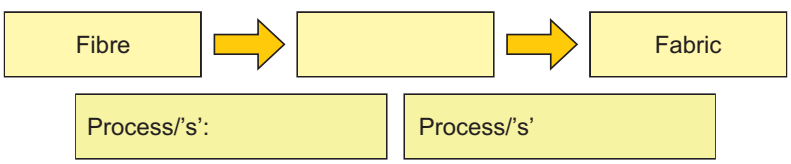
The art of producing fabrics directly from fibers matted together began before spinning and weaving were invented. Felting is the process of making fabric by the entanglement of fibers in the presence of heat, pressure and moisture. **Non-woven fabrics** are adhesive bonded fabrics , in which the fibers are held together by a binder such as synthetic rubber, heat bonded fabrics using a mixture of manmade fibers with different melting points and needle punched fabrics, in which the fibers have been entangled by barded needles .

All these non-woven fabrics have special uses such as interlinings and stiffeners for garments, disposable diapers or nappies, tea bags, bandages, hats, filters and carpets.

Net, lace, crochet, braiding, macramé, are some decorative knit fabrics.

Test your learning:

1. **Fill the missing gaps with respect to conversion of Fibre to fabric and mention the processes of conversion.**



2. Plot the basic weaves:

PLAIN WEAVE

BASKET WEAVE

RIB WEAVE

TWILL WEAVE

SATIN WEAVE

3. Match the following:

Knitting	entanglement of fibers
Weaving	smooth surface
Macramé	interloping
Felting	diagonal line
Twill weave	loom
Satin weave	decorative fabric construction

4. Plot the grains of a woven fabric