Woven Textiles

Textbook

CLASS

XI

CENTRAL BOARD OF SECONDARY EDUCATION

in collaboration with

NATIONAL INSTITUTE OF FASHION TECHNOLOGY

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भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक सम्पूर्ण [1][प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य] बनाने के लिए, तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,
विचार, अभिव्यक्ति, विश्वास, धर्म
और उपासना की स्वतंत्रता,
प्रतिष्ठा और अवसर की समता
प्राप्त कराने के लिए
तथा उन सब में व्यक्ति की गरिमा
और [2][राष्ट्र की एकता और अखंडता]
सुनिश्चित करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपनी इस संविधान सभा में आज तारीख 26 नवम्बर, 1949 ई॰ को एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977) से "प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य" के स्थान पर प्रतिस्थापित।
2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977) से "राष्ट्र की एकता" के स्थान पर प्रतिस्थापित।

भाग 4 क

मूल कर्त्तव्य

51 क. मूल कर्त्तव्य – भारत के प्रत्येक नागरिक का यह कर्त्तव्य होगा कि वह –

(क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;

(ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;

(ग) भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे;

(घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हों, ऐसी प्रथाओं का त्याग करे जो स्त्रियों के सम्मान के विरुद्ध हैं;

(च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परीक्षण करे;

(छ) प्राकृतिक पर्यावरण की जिसके अंतर्गत वन, झील, नदी, और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणिमात्र के प्रति दयाभाव रखे;

(ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई उंचाइयों को छू ले;

[1](ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य के लिये शिक्षा के अवसर प्रदान करे।

1. संविधान (छयासीवां संशोधन) अधिनियम, 2002 की धारा 4 द्वारा (12.12.2002) से अंतः स्थापित।

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the[2] [unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

1. Subs, by the Constitution (Forty-Second Amendment) Act. 1976, sec. 2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs, by the Constitution (Forty-Second Amendment) Act. 1976, sec. 2, for "unity of the Nation" (w.e.f. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV A

FUNDAMENTAL DUTIES

ARTICLE 51A

Fundamental Duties - It shall be the duty of every citizen of India-

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

[1](k) who is a parent or guardian to provide opportunities for education to his/her child or, as the case may be, ward between age of six and forteen years.

1. Ins. by the constitution (Eighty - Sixth Amendment) Act, 2002 S.4 (w.e.f. 12.12.2002)

Woven Textiles

Preamble:

Textile refers to any material made through weaving, knitting, crocheting, braiding, and other non-woven textiles. Development of textile involves complete cycle right from the development of fibre to fabric ranging from 100% natural fibres to 100 % synthetic materials. Then it also involves a complete vision of development of new design aspects for novelty in fabric surface, textile products and various other textile materials. It includes designing of fabric used in clothing, house hold textiles, decorative textiles and others. It involves design intervention along with the development of the final product within the technical specification and right commercial value.

In order to understand and create varieties of fabric using various innovative weaves "Woven Textiles" course is introduced as an elementary course. The course will provide an overview of Textiles which are produced in the Textile Industry. The overall objective of this course is to understand the basics textiles, related terminologies and the overall work pattern of textile industry

CBSE

Mr. Vineet Joshi, IAS

Dr. Biswajit Saha
(Associate Professor and Programme Officer)
Vocational Cell

Ms. Swati Gupta
(Assistant Professor and Assistant
Programme Officer), Vocational Cell

NIFT

Mr. Prem Kumar Gera, IAS

Sr. Prof Banhi Jha, Dean(A)

Prof. Kripal Mathur, Registrar

Anchor

Ms. Savita Sheoran Rana, Assoc. Prof.& Chairperson, Textile Design Department

Contributors

1. **Mr. Mohammed Javed**, Associate Professor, Textile Design Department, NIFT Mumbai
2. **Ms. Shubhangi Yadav,** Associate Professor, Textile Design Department, NIFT Gandhinagar

Foreward

The Indian Textiles Industry has an over whelming presence in the economic life of the country and is one of the leading textile industries in the world. India earns about 27% of its total foreign exchange through textile exports. Further, the textile industry of India also contributes nearly14% of the total industrial production of the country. It also contributes around 3% to the GDP of the country. India textile industry is also the second largest provider of employment in the country in terms of after agriculture.

As per the 12th Five year plan, the integrated skill development scheme aims to train over 2,675,000 people within the next 5 years. This scheme would cover all sub sectors of the textile sector such as textiles and Apparel, handicraft, handlooms, jute and sericulture.

In order to match the increasing requirement of skilled personnel, CBSE has initiated to introduce "Textile Design" as a vocational course for Class XI and XII. The course aims to introduce students to Elements of Design, Fabric science, Woven textiles, Dyeing & Printing procedures and introduction to our traditional textiles. This will help students to join the industry after Class XII or they can pursue higher education in this field.

The Faculty of the National Institute of Fashion Technology has developed the curriculum and the learning Material. I place on record the Board's thankful acknowledgement of the services rendered by Shri P. K. Gera, Director General, NIFT, Sr. Prof Banhi Jha, Dean- Academics, Project In-charge and Ms. Savita Sheoran Rana, Chairperson, Textile Design Department, Project Anchor - Textile Design. The course is developed and prepared by faculty members from Textile Design Department across NIFT centers. CBSE also acknowledges the contribution by Prof. Anupam Jain, Hyderabad, Ms. Kislay Choudhary, Assistant Prof. Bhopal; Ms. Shubhangi Yadav, Associate Prof, Gandhinagar, Mohammad Javed, Associate Prof., Mumbai; Shri. Arnab Sen, Assistant Prof, Bhopal, Mr. Debojyoti Ganguly, Assistant Prof., Bhopal and Shri. Shivalingam.

I would like to appreciate Dr. Biswajit Saha, Associate Professor and Programme Officer, Vocational Education Cell, CBSE and Ms. Swati Gupta, Assistant Professor and Assistant Programme Officer, Vocational Education Cell, CBSE and other members of Vocational Education Cell, CBSE is also deeply appreciated.

Comments and suggestions for further improving the curriculum are always welcome

Vineet Joshi
Chairman

Woven Textiles

Class XI **Theory and Practical Based**

Preamble

- To Introduce weaving and weaving terminologies
- To familiarize students to Weaving Technology, looms category and the preparatory processes
- To gain an overview of the various woven structures
- To introduce scope of Woven design industry.

Unit I – Introduction of Woven Textiles

Objective:

- To introduce students to the woven textiles industry.
- The unit deals with all the important definitions of woven textiles and various associated terminologies.
- To sensitize students towards fabric classification and different fibre types.
- Introduction of looms and its parts.

Course Content:

1. Introduction to Textiles –
   a. Introduction to textiles and various terminologies.
   b. The classification of textiles in terms of Woven *and* Non-Woven on the basis of fibre / yarn types.
2. Introduction to Weaving –
   a. Understand weaving, its history in terms of traditional weaving and the impact of Industrial Revolution.
   b. Weaving terminologies
      i. Ends /Warp
      ii. Picks / Weft
      iii. Selvedge
      iv. Fabric Construction - Ends / Inch and Picks /Inch
      v. Reed Count and warping calculations

3. Looms –

   a. What is a loom.

   b. Its classifications on the basis of shuttle and shuttle less looms, power loom, handloom, tappet, jacquard and dobby.

Learning Outcome:

At the end of the unit the student shall be able

- To differentiate types of woven fabrics
- To understand weaving technology
- To classify and identify various looms

Teaching Methodology:

- Illustrated lectures with power point presentations.
- The teacher shall plan a visit to a weaving unit of a composite textile mill.
- The teacher would be expected to create a library of fabrics to explain.

Assignment:

- **Preparation of Fabric Watch Book** – 10 sourced fabric swatches (8"x8") of woven, knitted and fused fabrics. The swatches should be made of different fibre and yarns.
- **Group Assignment**– Presentation by a group of 5-6 students. The group shall make a presentation on one type of Loom.

Evaluation Criteria:

- Selection of swatches , identification, classification and presentation as a swatch book.
- Presentation – verbal presentation, visual presentation, understanding of the topic, group management.
- Quality of work submitted.
- Viva- voice for swatch book and presentation.

Unit II – Weaving Technology

Objective:

- The unit will introduce the students to various loom mechanisms.
- Looms classifications and loom parts.
- To introduce yarn preparatory - an important prerequisite for weaving.

Course Content:

1. Weaving Mechanism –
    a. Complete loom details – its parts, motions and other terminologies associated with weaving
2. Loom Preparatory –
    a. Processes involved in preparation of loom for weaving – winding, warping, weft preparatory and denting
3. Introduction to Weave Design
    a. Usage of Point Paper / Graph Paper / Design Paper
    b. Methodology of Interlacement of Warp and Weft
    c. Construction of Fabric
    d. Design, draft and peg plan preparation
    e. Different types of draft plan

Learning Outcome:

At the end of the unit the students shall know,

- Complete details about Looms and its parts.
- The preparatory procedures for weaving
- The process involved in preparing design, draft and peg plan

Teaching Methodology:

- Illustrated lectures with Power Point presentations
- Visit to a composite textile mill – Preparatory Unit

Assignment:

- Setting up of loom – the student will individually set up a loom- three meters of warp, for eight inch wide swatches.

Evaluation Criteria

- Daily assessment on presentation of work
- Level of improvement if required
- Punctuality, regularity and sincerity
- Quality of loom setup

Unit III – Fabric Structure

Objective:

- To introduce fabric structures and design development.
- To develop plain, twill and sateen weave structure using point paper.

Course Content:

1. Introduction to Plain Weave
   - Characteristics of Plain Weave
   - Ornamentation of Plain Weave
   - Derivatives of Plain Weave
2. Introduction to Twill Weave
   - Characteristics of Twill Weave
   - Derivatives of Twill Weave
3. Introduction to Satin Weave
   - Characteristics of Sateen
   - Irregular Satin / Sateen

Learning Outcome:

At the end of the unit the students shall know,

- The three basic fabric structures
- How to draw the structures on design paper
- How to prepare design, draft and peg plan

Teaching Methodology:

- Illustrated lectures with Power Point Presentations
- The teacher would be expected to create a library of fabrics to explain and conduct the class.
- The swatches should be collected in terms of the different designs – stripes, checks, textures and other related designs which can be developed using these three weave structures.

Assignment:

- Weaving practical – to weave 3 swatches of 8”x8” of plain, twill and sateen weave.
- Preparation of document of the woven swatches.

Evaluation Criterion:

1. Quality of weaving
2. Quality of documentation
3. Regularity and sincerity

Unit IV – An Overview of the Weaving Industry

Objective:

- To introduce the students to the commercial aspect of the woven textiles.
- This unit will introduce the students to woven structures and usage of computer for making the designs.

Course Content:

1. An overview of the Textile Industry
   - i. Segments of Indian Textile Industry
   - ii. Basic structure of Textile Industry
   - iii. Handloom and Power loom Textile Industry
2. Identification of the fabrics with Commercial Names
   - i. Commercial names of the fabric
   - ii. Various Fabrics and its end uses
   - iii. Selection of fabric as per end use based on its quality
     - Clothing / Apparel
     - Home Fashion
     - Accessories
3. Computerization in Textile Design
   - i. Woven Structures and development of woven design on Computer

Learning Outcome:

At the end of the unit, the students shall be able

- To identify Fabric types and product categories.
- To identify fabric as per end use
- To develop design on computer

Teaching Methodology:

- Illustrated lectures with Power Point Presentations

Assignment:

- **Preparation of Fabric swatch book** – 10 fabrics swatches (8"x8") of plain, twill and sateen. The swatches should be of different types in terms of design patterns
- **Suggestive** – 1-2 swatches could be "NEW DESIGN" as identified by the students

Evaluation Criteria:

- Selection of swatches
- Identification and classification of Fabrics
- Presentation as a swatch book

Reference Material:

- Principles of Weaving - R. Marks, A. T. C. Robinson
- The Four-Shaft Table Loom - Anne Field, Dryad Press Ltd. London 1987
- Watson's Textile Design and Colour-I - Z. Grosiki, Universal Publishing, Bombay
- The Ashford Book of Weaving - Anne Field, B. T. Batsford, London, 1992
- Warp & Weft - A Dictionary of Textile Terms - Dorothy K. Burnham, Charles Seribner's Son, New York, 1981
- Textile Terms and Definitions- The Textile Institution, Manchester U.K. The Textile Institution, Manchester U. K. 1993
- International Textile Design - Mary Schoeser, John Wiley & Sons, Inc. 1995
- The New Textiles- Trends & Traditions - Chloe Colchester, Thames & Hudson 1997

Course Content

Unit - 1

Introduction to Woven Textiles

Chapter- 1: Introduction To Textiles

Fig 1.1: Textiles for Apparel

Fig 1.2: Home Textiles

1.1. INTRODUCTION

Manufacturing of textiles is one of the oldest industry. Textiles play an important role in our daily lives. It caters for the fundamental human need for clothing and for protection and fulfils basic demand for decoration.

Other than this, textiles also have an assortment of other uses, like making containers such as bags and baskets; in the household, they are used in carpeting, upholstered furnishings, window shades, towels, covering for tables, beds, and other flat surfaces, and also art pieces. In the workplace, they are used in industrial and scientific processes such as filtering, as belts, etc. Miscellaneous uses include flags, backpacks, tents, nets, handkerchiefs, cleaning rags, transportation devices such as balloons, sails, parachutes, etc.

1.2. WHAT IS FABRIC?

A Fabric may be defined as a planar assembly of fibre, yarns or combination of these.

There are many methods of fabric manufacturing, each capable of producing a great variety of structures depending upon raw materials used. The particular fabric selected

for a given application depends on the performance requirements imposed by the end use and/or the desired aesthetic characteristics of the end user with consideration for cost and price. Fabrics, as stated above, are used for many applications such as apparel, home furnishings and industrial. The most commonly used methods for fabric - forming are interlacing, interloping, bonding and tufting.

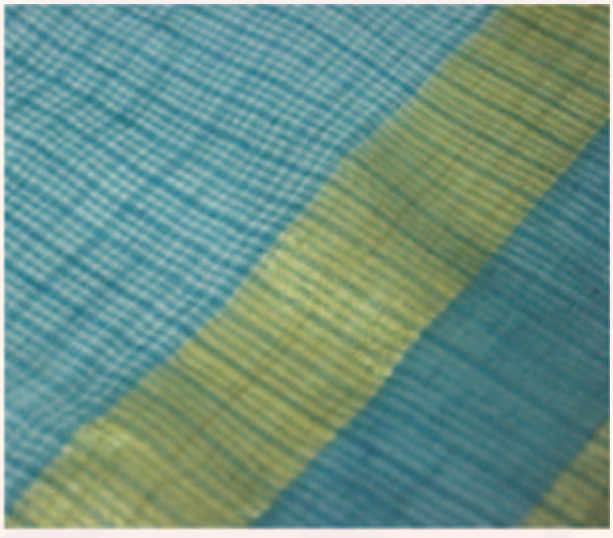


Fig 1.3: Close-up view of a Fabric

The words fabric and cloth are often used as synonyms for textile. However, there are subtle differences in these terms in specialized usage. **Textile** refers to any material made of interlacing fibres. **Fabric** refers to any material made through weaving, knitting, spreading, crocheting, or bonding that may be used in production of further goods (garments, etc.). **Cloth** may be used synonymously with fabric but often refers to a finished piece of fabric used for a specific purpose (e.g., table cloth).

1.3. THE RAW MATERIAL

Fig 1.4: Fiber and Yarn - The raw material for making a Fabric

The basic raw material used by the textile industry for making a fabric is Fibre. **Fibres** are delicate, hair portions of the tissues of a plant or animal or other substance that are very small in diameter in relation to their length. The essential requirement for the fibre to be spun into yarn includes a length of at least 5mm, flexibility, cohesiveness and sufficient strength. Many different kinds of fibres are used for making a Yarn. The strands of fibres are twisted or spun together to form a **Yarn** that is made into a Fabric.

Some of these fibres are being used since the earlier years of civilization till today, with modifications and enhancement. Some fibres have been developed over the years in laboratory and have acquired varied degree of importance in the recent years.

The factors influencing the development and utilization of all the fibres include their ability to be spun, their availability in sufficient quantity, the cost or economy of production and the desirability of their properties to consumer.

1.4. TYPES OF TEXTILE FIBRES

Fig 1.5: Animal Fibre - wool

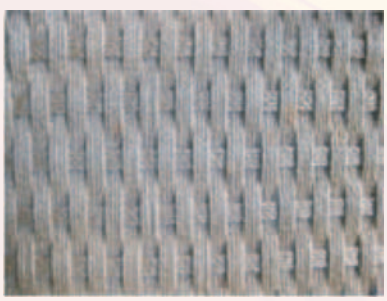


Fig 1.6: Vegetable Fibre - Jute

Fig 1.7: Mineral Fibre - Asbestos

Fig 1.8:Yarns from Manmade Fibres

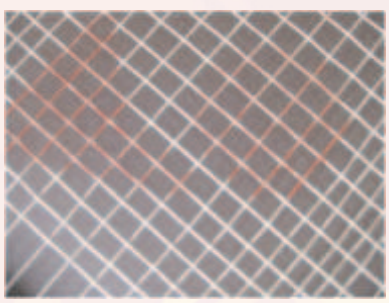


Fig 1.9: Nylon Fibre - being used as Racket Net

The textile fibres are of two types -

1.4.1. **Natural Fibre -** These fibres include those produced by plants, animals and geological processes. They are biodegradable over time. They can be classified according to their origin

a) **Animal Fibre -** They are produced by animals or insects and are protein in composition, E.g.: Silk fibre and Wool fibre

b) **Mineral Fibre -** These are mined from certain types of rocks, E.g.:Asbestos fibre

c) **Vegetable Fibre -** They are found in the cell wall of plants and are cellulosic in composition. E.g., cotton fibre, jute fibre.

1.4.2. Manmade Fibre - These are derived from various sources. For instance,

a) **Manmade Cellulosic Fibre -** The natural material of cellulose can be taken from cotton linters and wood pulp, processed chemically and changed in form and other characteristic to form manmade cellulosic fibre. E.g.: Rayon, Modal

b) **Non-cellulosic Polymer Fibres -** They are synthesized or created from various elements into large molecules which are called linear polymers because they are connected in link-like fashion. E.g.: Acrylic fibre, Nylon fibre, Polyester fibre

c) **Metallic Fibers -** They are composed of metal, plastic coated metal, metal-coated plastic or a core completely covered by metal. They are used as decorative yarn for various apparel and home furnishings.

d) **Minerals Fibers -** Various minerals have been manufactured into glass, ceramic and graphite fibers having prescribed properties for specific use. E.g.: Glass fibers

1.5. CLASSIFICATION OF TEXTILES

Fig 1.10:Woven Fabric

Fig 1.11:Knitted Fabric - used as Sweater

Fig 1.12: Non-woven Fabric - used as Tissue

Fabrics maybe classified on the basis of way they are formed. The most commonly used fabric forming methods are:

1.5.1. Interlacing - Weaving

Interlacing of lengthwise yarn (warp) with the width wise yarn (weft/ filling) which are perpendicular to one another. Example: Shirting

1.5.2. Interloping - Knitting

Interloping of one yarn system into vertical columns and horizontal rows of loops called wales and courses respectively with fabric coming out of the machine in the wales direction. Example: Sweaters, hosiery

1.5.3. Bonding (Non-Woven / Felting)

Bonding together of entangled fiber or filament or yarn, mechanically, thermally or chemically to form a sheet or web structure. Example: Lining in automobiles

1.5.4. Tufting

"Sewing" a surface yarn system of loops through a primary backing fabric into vertical columns (rows) and horizontal lines (stitches) forming cut and/or uncut loops (piles) with the fabric coming out of the machine in the rows direction. Fabric must be back-coated in a later process to secure tufted loops

1.6. TECHNICAL TEXTILES

Textiles used for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as **Technical Textiles.** Technical textiles include textile structures for automotive applications (Tire cord fabric in tires), medical textiles (e.g. implants), geotextiles (reinforcement of embankments), agro textiles (textiles for crop protection), protective clothing (e.g. against heat and radiation for fire fighter clothing, against molten metals for welders, stab protection, and bullet proof vests).

They are designed to work for heavy duty and demanding applications. In all these applications stringent performance requirements must be met as any failure of an industrial textile can devastating. For example, failure of an air bag in a car accident or an astronaut's suit during a space walk may be fatal.

Summary:

A textile is one of the oldest industries. There are various forms of raw materials required to make a fabric. There are many ways of making it. This chapter will introduce the student to the world of Textiles. It will define the fabric and the raw material used to make a fabric - yarn and fiber. It will tell in brief the classifications of fibres and various types of textiles. It will also introduce the student to the term Technical Textiles.

Chapter- 2: Introduction To Weaving

Weaving is a method of fabric production in which two distinct sets of yarns are interlaced at right angles to form a fabric. The fabric is usually woven on a **loom**, a device that holds the **ends or warp** (vertical Yarns) in place while **picks or filling yarns** (horizontal yarns) are woven through them. The way the warp and filling threads interlace with each other is called the **Weave**.

2.1. HISTORY OF WEAVING

It is not known clearly how weaving began, but it appears that the idea of weaving certainly preceded looms by many thousands of years. There is mention of invention of weaving in the legends of most of the culture, except for the Chinese.

It can be presumed that the man first got the idea to weave by maybe observing certain birds that weave nests or watching the wind interlace the leaves of date palm or see the spider making its net on the bush or by studying the silkworm to see if thread can be made usable. There are innumerable legends and stories in every culture that are linked with notion of weaving but in every story it appears that nature itself planted the first seeds of weaving.

Plaiting and Baskets making was a preliminary step to weaving cloth. Various different forms of basketry techniques were employed wherein different types of fibers, roots were coiled, intertwined to make baskets. These were initially used as vessels for carrying fish from fish traps and roots and berries from forests but they were eventually applied to hampers, cradles, etc. Basketry was modified to mat-making used for carpets, coverings, wrappings as well as temporary shelters for house.

2.2. EARLIEST LOOMS

The weaving of textiles on the loom is believed to have begun in Neolithic Age (Neolithic Age or the New Stone Age was a period in the development of human technology). The "Loom" of that age is best defined as any frame or contrivance for holding warp threads parallel to permit the interlacing of the weft at right angles to form a web. Hence the looms have evolved from the simplest structure wherein the warp were freely suspended from cord stretched between two upright wooden poles to the sophisticated looms of the modern age.

2.3. DEVELOPMENT OF TEXTILE INDUSTRY

In early age, weaving on looms was a house hold activity practiced mainly by women. With the invention of horizontal loom men took over the activity of weaving and this signals the birth of European weaving as a commercial enterprise.

The horizontal looms made it possible to weave long lengths of fabric and at speed more than the primitive looms. This brought about the commercialization of cloth production in urban areas. The industry started becoming specialized which involved processes that occurred after the weaving of the cloth. These finishing processes distinguished the products of horizontal looms from the other primitive looms. However, in rural areas peasants still continued to spin, dye and weave their own cloth, till the cloth became cheap enough for the peasants to be able to buy for themselves.

2.4. MECHANIZATION OF LOOMS

The thrust towards mechanization of looms began before Industrial Revolution. Experiments towards making mechanical looms had started but the real push towards power-loom weaving came with the development of spinning machinery in order to keep pace with the spinners. After many unsuccessful attempts a solution was arrived at by invention of an Anglican clergyman named Edmund Cartwright. Cartwright powered his first loom by an ox and capstan but this was soon adapted for a steam version.

A Manchester factory manufactured this loom. Workers protested over loss of jobs which lead to rioting in early nineteenth century England, but Industrialization had started. One operator with one help could operate four looms and produce twenty times the output of a hand weaver. The golden age of hand-weaving came to an end in England and the artisans went in anonymity. Home weaving of course continued as before on traditional looms.

Summary:

This chapter will take the student through the journey of evolution of Weaving Industry. It starts from early age giving an idea as to how possibly weaving could have originated. The loom - device used to weave fabric - has also evolved. It started from a simple frame, to handloom loom to a power driven machine. The chapter traces the journey of this development of loom to the development of Textile Industry. It also explains as to how the demand of the fabric increased which lead to making it as an Industrial Product.

Chapter- 3: LOOMS

Weaving is done on a machine called **loom**. The weaving machine provides the means to interlace warp and filling yarns to form woven fabric. It provides mechanisms by which different interlacements are made possible for warp yarns and weft yarns. Over a period of time, the loom has undergone significant modification, but the basic principles and operation remain the same.

3.1. CLASSIFICATION OF LOOMS

The loom is classified on the basis of method of insertion of weft. There are many ways for insertion of filling. The basic classification of the looms is as follows:

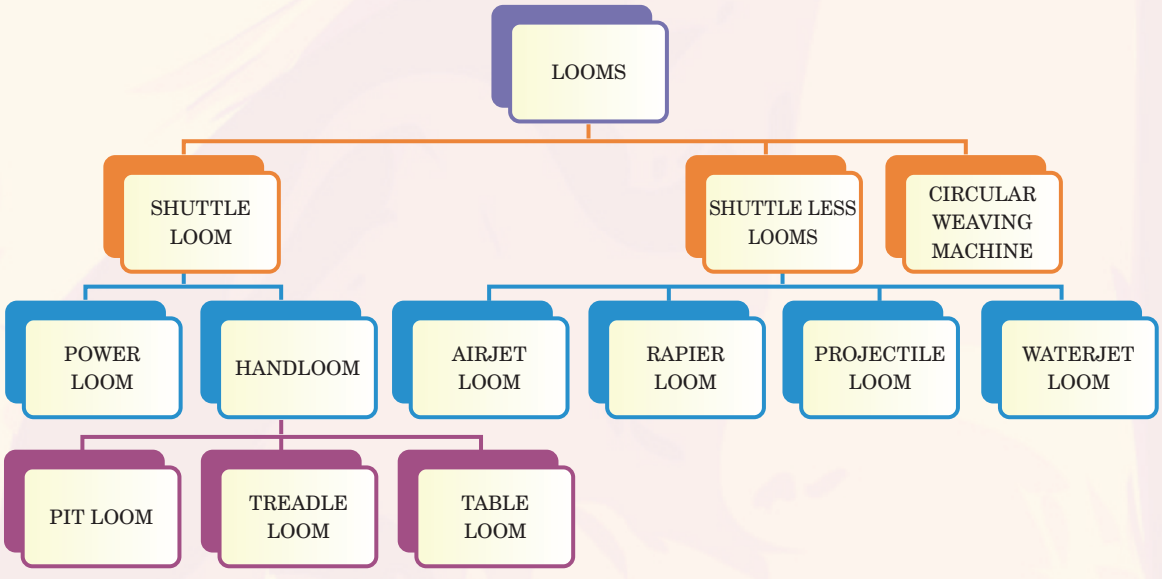


Fig 3.1: Loom Classification Diagram

3.1.1. SHUTTLE LOOMS

For many years weaving machines depended on shuttle as the primary device for weft insertion. **Shuttle** is a device that contains a bobbin on which filling yarn is wound. The shuttles are available in different shapes depending on the type of loom they are to be used. Shuttle looms are among the oldest kind of looms. They are versatile and effective but there are certain disadvantages. As the shuttle passes over warp ends during every picking cycle, it causes abrasion, which lead to thread breakage. So it cannot be used for

weaving finer count yarn fabric varieties. Compared to more modern looms they are also slow and noisier. Shuttle looms can be power looms which are used in mill sector or could be different varieties of handloom which are usually used by artisans (craftsmen)

Fig 3.2: Shuttle Loom

3.1.2. SHUTTLELESS LOOMS

Shuttle less looms were developed to overcome the problems of Shuttle looms. These looms were faster and also reduced the breakage of yarn during weaving. Finer fabric qualities like shirting and dress material could be manufactured with these looms. The modern looms use three prominent devices for pick insertion.

3.1.2.1. Projectile Looms:

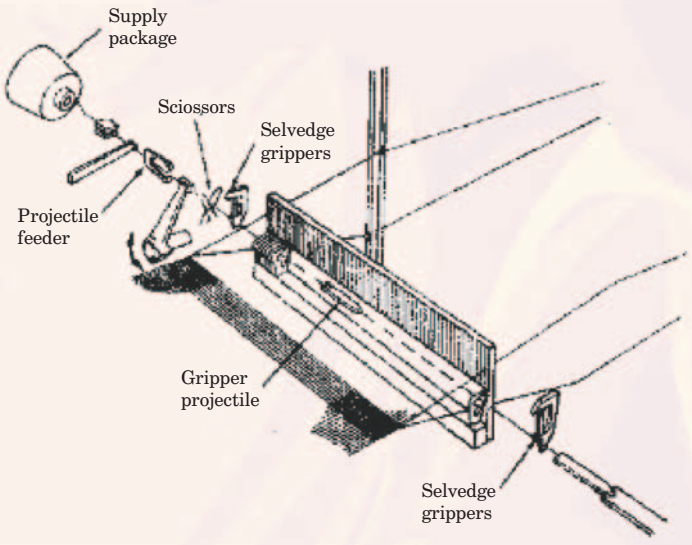


Fig 3.1: Line Diagram of Projectile loom

This is the first proven Shuttle less loom developed in 1950s in Switzerland. The projectile is like a bullet which grips the weft and carries it through the shed and returns empty. It can be used to make wide variety of basic fabrics, but it requires the yarn to be smooth and uniform to reduce friction.

3.1.2.2. Rapier Looms

Fig 3.4: Close up view of a Rapier

Rapiers, used to insert the weft, are of two types - **Single Rapier and Double Rapier**. Single rapier is one long rapier device that carries the weft from one side of the loom to other and returns back empty. Whereas in double rapier, one rapier feeds the weft halfway through the shed to another rapier, which then carries it across rest of the way. The double rapiers could be rigid, flexible or telescopic.

3.1.2.3. Airjet Looms

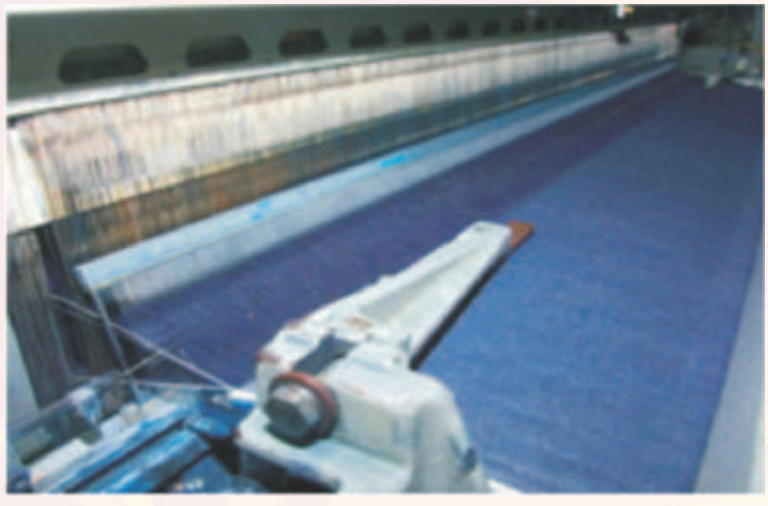


Fig 3.5: Airjet Loom

The looms use jet of air to propel the weft yarn across the shed of the loom. These looms are faster and also less noisy than the shuttle looms, rapier and projectile loom. The filling yarn is also under less tension. Airjet looms are used for producing wide variety of fabrics.

3.1.2.4. Waterjet Looms

Fig 3.6: Waterjet Loom - Observe the lustre on the fabric, it is because the fabric is wet due to water.

The jet of water is used to carry the weft yarn across the shed of the loom. These looms are faster and operate at less noise level like air jet looms. But the disadvantage is that they are restricted to produce the fabrics that do not readily absorb water such as nylon, polyester, etc.

3.1.2.5. Modern Looms

Innovative approach to weaving has been introduced through several design modifications of shedding and picking components of the traditional weaving machine.

3.1.2.5.1. Circular looms

These looms are designed to produce circular fabrics. In these looms shuttles are used that circulate the pick in the shed, which is formed around the machine. The circular looms at present are primarily used for bagging material.

Summary:

This chapter explains in detail the Loom - the machine on which weaving is done. Based on the method used for weft insertion, the looms are classified in to various categories. There are various techniques of weft insertion. An industry uses a given method depending on its requirement like - speed, type of fabric, end user and budget. The student in this chapter will understand the various types of looms that are being used in the industry. It also introduces the Modern Looms.

Unit - 1 Assignment

I. Fill in the Blanks

1. The basic raw material used by the textile industry for making a fabric is _____.
2. Any material made of interlacing fibers is called _____.
3. A finished piece of fabric used for a specific purpose is called _____.
4. The two types of textile fibers are _____ and _____.
5. The examples of Manmade Fibers are _____ and _____.
6. Interlacing of lengthwise yarn (warp) with the width wise yarn (weft/ filling) which are perpendicular to one another is called _____.
7. Weaving is done on a machine called _____.
8. _____ is a device that contains a bobbin on which filling yarn is wound.
9. _____ looms types are faster and also reduced the breakage of yarn during weaving
10. Rapiers, used to insert the weft, are of two types -_____and _____.
11. _____ looms are restricted to produce the fabrics that do not readily absorb water.
12. The circular looms at present are primarily used for _____ material.
13. Textiles used for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as _____ Textiles.
14. The way the warp and filling threads interlace with each other is called the _____.
15. The weaving of textiles on the loom is believed to have begun in _____Age.

II. True or False

1. The shuttles are available in different shapes depending on the type of loom they are to be used
2. Interlooping of one yarn system into vertical columns and horizontal rows of loops called Weaving
3. Thestrands of fibers are twisted or spun together to form a Yarn
4. Wool fibers are a form of vegetable fibers

5. Plaiting and Baskets making was a preliminary step to weaving cloth
6. Shuttle looms were developed to overcome the problems of Shuttle-less looms
7. The basic raw material used by the textile industry for making a fabric is Yarn.
8. The Projectiles are looms classified on the basis of weft insertion technique
9. Lining in Automobiles is an example of Bonded Fabric
10. Cloth may be used synonymously with fabric but often refers to a finished piece of fabric used for a specific purpose

III. Select the Correct Answer from the options given below (MCQs):

1. In early age, weaving on looms was a house hold activity practiced mainly by:
   a. Men
   b. Women
   c. Children
2. _____ is a Natural Fiber
   a. Nylon
   b. Polyester
   c. Jute
   d. Glass Fiber
3. The first loom was powered by :
   a. Edmund Cartwright
   b. Thomas Alva Edison
   c. Wright Brothers
   d. Graham Bell
4. The looms use jet of air to propel the weft yarn across the shed of the loom
   a. Waterjet
   b. Projectile
   c. Rapier
   d. Airjet
5. A delicate, hair portions of the tissues of a plant or animal or other substance that are very small in diameter in relation to its length are called
   a. Yarn
   b. Fabric

c. Fiber

d. Cord

6. The example of knitted fabric is

   a. Sweater

   b. Towels

   c. Handkerchief

   d. Bed sheet

7. Interlacing of lengthwise yarn (warp) with the width wise yarn (weft/ filling) which are perpendicular to one another is called

   a. Knitting

   b. Bonding

   c. Weaving

   d. Tufting

8. The fabric is usually woven on

   a. Spindle

   b. Loom

   c. Warper

   d. Charkha

IV. Define the Following:

1. Fiber
2. Yarn
3. Fabric
4. Looms
5. Manmade Fibers
6. Natural Fibers
7. Projectile Looms
8. Rapier Looms
9. Airjet Looms
10. Circular Looms

V. Answer the following the Questions:

1. Differentiate between Shuttle and Shuttle-less Looms
2. What are the various classifications of Textiles? Explain with examples
3. Write in brief about "Mechanization and Industrialization"
4. What are Natural Fibers? Classify and give examples
5. Draw a diagram of the Classification of Looms
6. What are Manmade Fibers? Classify and give examples
7. What are Airjet Looms?
8. What are Rapier Looms?
9. What is Fabric? Explain in detail.
10. Write a short note on Technical Textiles.

Unit - 2

Weaving Technology

Chapter- 4: Loom Preparatory

4.1. INTRODUCTION

As taught in the earlier Units, a woven fabric is made of two yarn systems, the **filling** or width-wise yarns and **warp** or lengthwise yarns, which are interlaced almost perpendicular to one another in weaving process.

The filling yarns or picks are not subjected to the same type of stresses as are the warp yarns and thus are easily prepared for the weaving process. Most often the filling yarns are taken straight off the spinning process and used for picking, after dyeing, if required.

But the yarns that are used as warp have to run from the back to front of the loom and hence should pass through a series of operations, to prepare them to withstand the strains of the weaving process.

All the processes through which the warp yarn passes are collectively called as **Weaving Preparatory processes**. An entire segment of textile industry has developed around this one aspect of woven fabric production. Successful warp preparation depends on fundamental understanding of the prior influences of yarn forming and a sound comprehension of the stresses of weaving.

Fig 4.1: Flow chart for Yarn Preparatory Process

4.2. PREPARATORY PROCESS FOR WEAVING

4.2.1. Preparatory for Warp

4.2.1.1. Winding -

Fig 4.2: Winding Machine

Yarns are repackaged as large cones, so that they can be further used for weaving process. This re-packaging process is termed as **winding**.

During this process, some spun yarns may be imparted more twist or combined with other single yarns into double and ply yarns. The defects in the yarn, like thick places and thin place are also removed. This leads to increase in overall strength of the yarn and causes less yarn breakage during weaving

4.2.1.2. Creeling

Fig 4.3a: Yarn being unwound from Creel

Fig 4.3b: Creel

Yarn packages are placed on a large metallic frame known as creel (Fig 4.3a and 4.3b). These creels are equipped with yarn tensioning devices so that constant

yarn tension is maintained in all the yarns as they are being wound onto the warp beam. The modern day creels are equipped with automatic control, centralized tension variation and yarn breakage monitoring system in order to increase the warping performance.

4.2.1.3. Warping

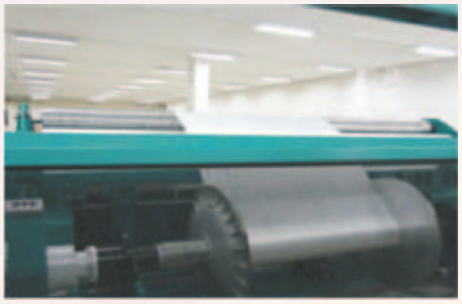


Fig 4.4: Direct Warping Machine

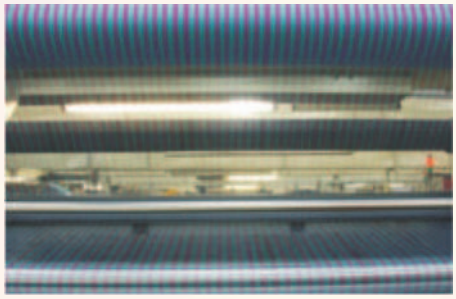


Fig 4.5: Sectional Warping Machine

The process of converting yarn from single end package to an even sheet of yarn representing hundreds of ends (multiple end package) is called Warping. The ends are then wound onto the warp beam. Warping can be done in two ways:

a) **Direct warping -** The ends of the yarn are wrapped in single operation from the yarn packages onto the warp beam. This method is predominantly used when single colour or less complicated patterns are to be woven (Fig.: 4.4)

b) **Indirect warping -** The yarns from the yarn package are wound in bands onto an intermediate drum called Pattern Drum and are then transferred onto a warp beam in a separate operation. This method of warping is employed when fancy coloured patterns of warp are need or the capacity of creel is limited (Fig.:4.5)

4.2.1.4. Sizing

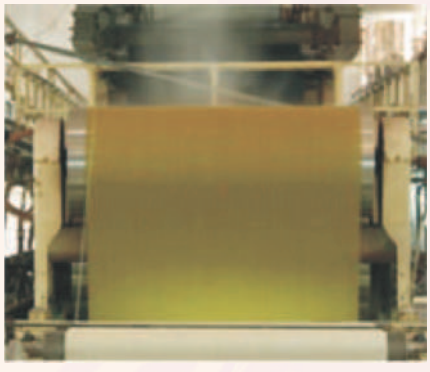


Fig 4.6: Sectional Warping Machine

Sizing of the warp yarn is essential to reduce breakage of the yarn and thus the production stops on the weaving machine.

On the weaving machine, the warp yarns are subjected to several types of actions, like abrasion at various loom parts, inter yarn friction, etc. With sizing, the strength - abrasion resistance - of the yarn improves and hairiness of the yarn also decreases.

The sizing paste is applied on the warp yarn with the warp sizing machine. After weaving process, the fabric is washed to remove the size paste (Desizing)

4.2.1.5. Drawing-in and Denting

Fig 4.7: Drawing-In

Fig 4.8: Denting

This is the process of drawing each end of the warp separately through the eyes of the heald, (Fig.:4.7) as indicated in the draft and then through the dents of the reed (Fig.:4.8).

- The order in which the warp threads are threaded in the heald shaft is known as "**Drafting Order**".
- The order in which the warp threads are threaded in the dents of the reed is known as "**Denting Order**".

The manual process of Drawing-in and Denting is time consuming and hence when mass production of same fabric is to be done then simply each end of new beam is tied to corresponding end of old beam. This is called **Tying-In**.

4.2.2. Preparatory for weft

a) Pirning

This process is need only for the looms that use Shuttle to carry the weft. In more modern, shuttle-less looms, the cones are directly put on to the stand for picking.

Summary:

A fabric is made up of two sets of yarn - Warp and Weft. These yarns have to withstand various strains during the Weaving Process. Hence, it passes through a series of processes before it is taken on loom. These are called Weaving Preparatory Processes. These processes are done in a typical order and vary for different types of yarns or the end fabric to be produced. This chapter introduces the student to the Weaving Preparatory Process i.e. all the processes through which the yarn passes before it is taken on loom for weaving.

Chapter- 5:

Weaving Mechanism

The Fabric weaving is accomplished on sophisticated, high speed, precision **loom**. But for understanding the complicated operations of a weaving, the machine can be broken down into simple functions, related to the process of cloth formation with particular reference to those functions which have the greatest influence upon the structure and the appearance of fabrics.

5.1. PASSAGE OF YARN ON THE LOOM

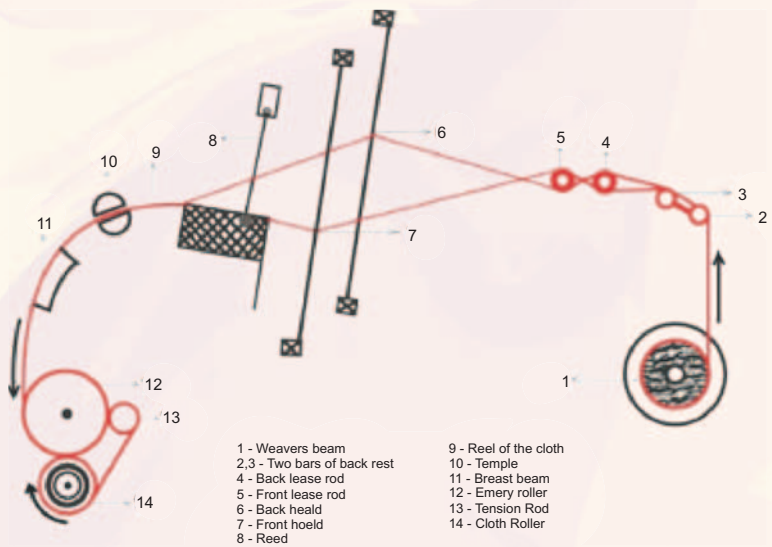


Fig 5.1: Line Diagram of Passage of Yarn (Ends) on the Loom

The passage of warp through the loom is as shown in the diagram (Fig 5.1). The warp leaves the **Weaver's Beam (No. 1)** and passes over the **Back Rest (No. 2, 3)**. From here half the warp ends pass over the **Back Lease Rod 1 (No. 4)** and under the **Back Lease Rod 2 (No. 5)** and the remaining half pass under lease rod 1 and over the lease rod 2. This divides the warp sheet into two parts which avoids entanglement and facilitates straightening of warp ends. The lease rods also help in forming an even shed. After this the warp yarns are drawn through the **Heald Shafts (No. 6, 7)** as per the design requirement. The Heald Shafts contain **Heald Wires** with **Heald Eyes** at the center through which the warp ends are passed. The warp ends next pass through the **Reed (No.8)** which is like a flat wire comb. The point 9 is the "**Cloth Fell**"; it is the point where the warp and weft become a cloth, as the reed beats up the last inserted weft up to this

point. The cloth is then held at each side by **Temple (No.10)**. This holds the cloth fell out to the width of the warp sheet. The cloth is then passed over the **Breast Beam (No.11)** and goes partly around the **Emery Roller (No.12)**, then over the **Tension Rod (No.13)** to be wound onto the **Cloth Roller (No.14)**.

5.2. IMPORTANT PARTS OF A LOOM

5.2.1. Heald Shaft

This part is related to the Shedding Mechanism. It can be made up of wood or metal. It carries number of heald wires, at the center of which is the heald eye. The ends of warp sheet pass through these heald wires. The number of Heald shafts used in weaving depends on the **Repeat** of the weave. The main functions of heald shafts are:

- It helps in shed formation
- It helps in identifying the broken warp thread.
- It determines the order of lifting and lowering the warp ends for a pick

5.2.2. Reed

It is a metallic comb which is made up of number of wires. The gap between these wires is known as **Dent**. The reed performs the following functions:

- It pushes the last inserted pick to the fell of the cloth.
- It keeps the warp ends in its position and avoids entanglement.
- It determines the fabric density, i.e. the number of ends per inch of the fabric.

5.2.3. Warp Beam

This is also known as the **Weaver's Beam**. The warp sheet is wound on to this beam and it is fixed at the back of the loom.

5.2.4. Back Rest

Back Rest or Back Beam is above the weaver's beam. It acts as a guide to the warp sheet coming from the weaver' beam and also as a sensor for sensing the warp tension

5.2.5. Breast Beam

The breast beam or the front rest is between the temples and the cloth roller at the front of the loom and it acts as a guide for the cloth being wound on to the cloth

roller. The front rest along with the back rest keeps the warp sheet and cloth in the horizontal position and maintains proper tension to facilitate weaving

5.2.6. Cloth Beam

It is also called as cloth roller. The woven cloth is wound on to this roller. This roller is at the front of the loom

5.3. BASIC OPERATIONS IN WOVEN CLOTH PRODUCTION

The weaving process consists of three basic operations which form a continuous cycle whether in the simplest hand-loom or in the most complex automatic loom. These **Primary Motions of Weaving** are as follows:

5.3.1. Shedding -

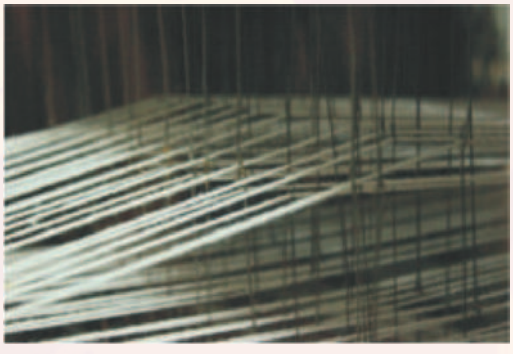


Fig 5.2: Shedding of Warp Sheet

The separation of the warp threads into upper and lower layers forming a Shed, or a tunnel, through which the weft is passed (Fig.:5.2).

5.3.2. Picking -

Fig 5.3: Picking with a Shuttle

The insertion of the weft thread, which traverses across the fabric, through the shed (Fig.:5.3).

5.3.3. Beating-up -

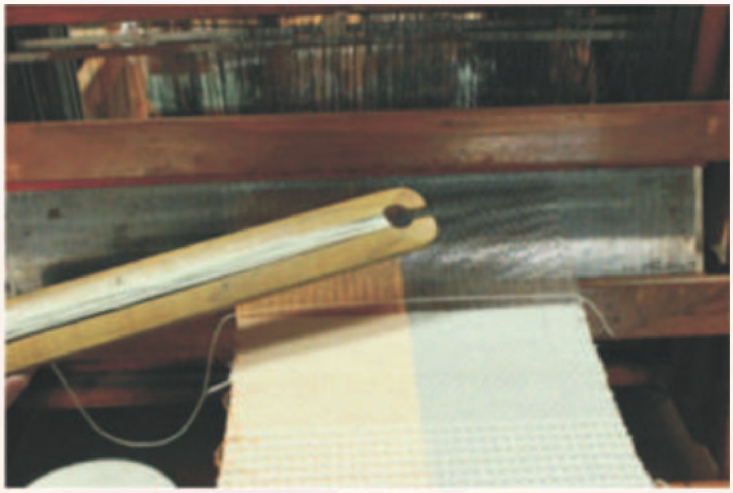


Fig 5.4: Beating with the Reed

The carrying forward of the last inserted pick or weft, to the fell of the cloth (Fig.:5.4).

The picking and the beating-up operations are fixed no matter what type of fabric is being produced, but the shedding motion is variable and can be described as the heart of weaving as it is here that the nature of the interlacing or the weave, is decided. The different shedding motions are described further in the chapter.

In addition to the three principal operations, several ancillary motions are required for control purpose. Some of these are mechanical devices connected with the safety and the continuity of weaving operations, but influence of some motions can alter the cloth appearance considerably.

These Auxiliary motions are as follows:

5.3.4. Warp Let-Off -

This determines the rate at which the warp is fed forward and the tension of the warp yarn. The tension is largely responsible for the configuration of warp ends in the cloth and two fabrics of identical design but woven with varying degrees of tension may appear different and may possess different characteristics

5.3.5. The Cloth Take-Up -

This determines the speed of cloth withdrawal and therefore, the density of spacing of the weft picks (i.e. the Picks per inch) in the cloth

The other mechanisms are as follows:

5.3.6. Warp-Protector motion -

This stops the loom to prevent excessive damage to the warp threads, cloth, and reed if a shuttle becomes trapped between the top and bottom shed lines and the reed is failing to complete its traverse.

5.3.7. Warp and Weft-Stop Motion -

This will stop the loom almost immediately if a warp end or a weft thread breaks, thus avoiding defects in the fabric.

Yarns must remain completely parallel from warp beam to cloth beam and not cross each other. If they do cross each other it may cause warp yarns to break, which ultimately results in fabric defects.

5.4. WEAVING

The weave structure in the fabric is determined by two factors.

- The order in which the warp threads are threaded in the heald shafts and in the reed.
- The combination of heald shafts raised or lowered at a time, and the sequence in which the heald shafts are raised or lowered

5.5. IMPORTANT WEAVING TERMINOLOGIES

5.5.1. Fabric Density

The fabric density is defined as the number of ends and picks in a unit of a fabric. It is measured as ends per inch and picks per inch

5.5.2. Ends per inch (EPI)

This is defined as the number of ends in one inch of the fabric. To get the required warp density, reeds of different counts are used.

5.5.3. Reed Count

The Reed Count is defined as number of dents in two inches. Through each dent, two, three or more ends can be passed. So for example, if you are using a Reed Count of 32s, it means there are 16 dents in one inch, so with 2 ends per dent, the EPI would be 32 (16x2=32). Reeds of different counts are available which help in making fine or thick cloth or changing the number of ends per dent can help to achieve open or close fabric.

5.5.4. Picks per inch

This is defined as the number of picks in one inch of the fabric. The density of picks can be varied by changing the take-up speed. If the take-up speed is high then Picks per inch is less. This is so because as the fabric is wound at the greater speed the picks are being laid further apart, where as if the take up is slow then the picks per inch is higher as the fabric is now being wound at a slower speed.

5.5.5. Selvedge

The selvedge of the fabric is the self-finished edges of the fabric.

5.5.6. Total warp ends

This is defined as the total number of ends across the width of the fabric. This is a product of the Ends per inch of the fabric and Width of the fabric to be woven.

For example, if the EPI of the fabric is 30 and 60 inch wide fabric is to be woven, then the Total Warp Ends will be equal to 1800 (30x60)

5.6. SHEDDING MECHANISM

As you learnt that the shedding, during which the warp threads are manipulated to produce a given interlacing, is achieved by threading each end through an eye of a heald wire, and raising or lowering this wire dependent on whether it is required to lift the end above the weft, or to keep it below the weft during picking. This can be achieved in the following three ways:

5.6.1. Tappet Shedding Mechanism -

In this the heald wires are not operated singly but are attached to heald frame and hence rise or fall together with the movement of the shaft. The tappet system is used to control the shedding where, due to simplicity of interlacing; only few heald shafts are required. But this imposes limitation on length of design. For these reasons tappet principle of shedding is employed mainly for high speed production of standard cloths where changes of structure are infrequent, and simplicity offers some advantage.

5.6.2. Dobby Shedding Mechanism -

Here as well, the heald wire are attached to heald shaft like for tappet shedding, but this system offers considerably greater scope for producing figured effects and are often capable of controlling up to 24 healds.

Fig 5.5: Cloth woven with Dobby Mechanism

5.6.3. Jacquard Shedding Mechanism -

Fig 5.6: Cloth woven with Jacquard Mechanism

These looms allow weaving of complex patterns. They are used for weaving designs which are beyond the scope of Dobby Shedding like brocades, damask, etc. i.e. the designs which consists of more than 24 different order of interlacing.

In these looms there are no heald shafts. Each heald wire is controlled separately by the Jacquard mechanism and hence thousands of ends can work in different fashion and repeat upon similar number of picks

Summary:

The actual Weaving process is a complex process comprising of series of operations. But the weaving mechanism is explained in this chapter by breaking it down into simple functions. With help of a line diagram all the parts of the looms are explained. The machine is broken down into simple functions, related to the process of cloth formation. Particular reference to those functions is given which have the greatest influence upon the structure and the appearance of fabrics. The chapter explains the basic operations for woven cloth production. It will also introduce the students to all the weaving terminologies that will be used while actual making of a fabric.

Chapter- 6: Weave Desiging

6.1. INTRODUCTION

Woven Fabrics are made up of vertical (Length wise) yarns called **Warp** and horizontal (width wise) yarns called **Weft**. These threads are interlaced with one another in many different ways and each class of structure forms the **Design**. The warp threads are also known individually as Ends and the weft threads are known as **Picks or Filling**.

The woven structures are divided into two major categories:

Simple Structure:

When the Ends and Pick intersect with one another at right angle and are respectively parallel to each other, then the structure is called as Simple Structure. In these structures there is only one series of ends and one series of picks and they equally contribute to performance, utility and aesthetic appearance.

Compound Structure:

In this structure, there are more than one series of ends and picks and some of which will be responsible for performance and some would be employed purely for the ornamentation purpose. They may also not be parallel to each other.

6.2. METHOD OF FABRIC REPRESENTATION

The unit of a woven fabric is the point of intersection of warp and weft. This intersection is of two types:

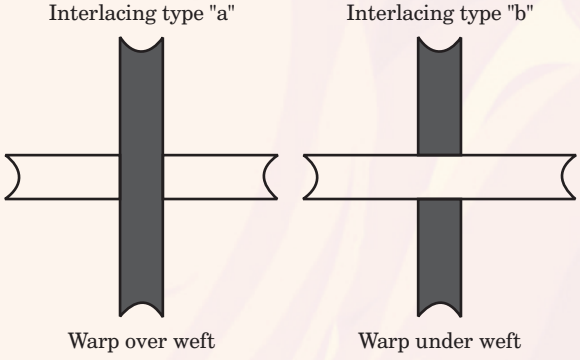


Fig 6.1: Condition 1: Warp over Weft
Condition 2: Warp under Weft

- End raised over the Pick to obtain the intersection
- End lowered under the pick to obtain the intersection

A number of different intersections combine to make a unit of a **design** or one **Repeat of the weave**. A simplest design that can make a cloth requires two ends and two picks as a repeat of a design. As the Fig: 6.2 represents one unit of a design (shown in red border), the adjoining units are identical to the first one. Therefore, usually it is sufficient to represent the interlacing pattern of the design as one Repeat.

Fig 6.2: One unit of a Design (Red outline)

Fig 6.3: Interlacing Diagram

The design depiction as shown in the Fig 6.3 represents warp 1 going over weft 1 and below weft2, and warp2 going below weft1 and above weft2. This is called as an Interlacing Diagram. They are very laborious to prepare and hence are generally not employed especially when large designs have to be made.

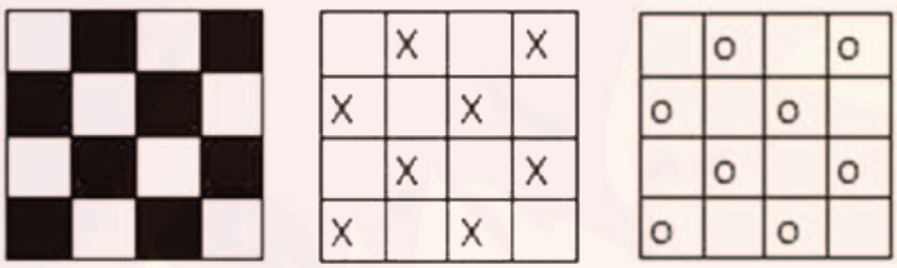


Fig 6.4: Design on Design Paper / Point Paper

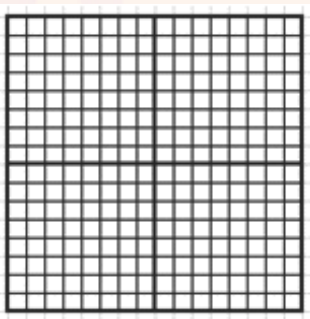


Fig 6.5: Design Paper / Point Paper /Squared Paper

The common method used for design depiction is **Design Paper** (Point Paper, Squared Paper) as shown in Fig6.5. This offers an easier method of representing the interlacing. The standard textile design paper is ruled in groups of 8 x 8, these being separated by bold lines. Each vertical space represents warp end and each horizontal space represents weft end, therefore, each square grid represents intersection of an end and a pick. A mark in this square indicates "Warp over weft" and a blank indicated "Warp under weft". Any kind of mark can be used (X, O, etc.) and sometimes several types of marks are used simultaneously in one design to indicate different colour or thickness of yarn. (Example Fig 6.4).Whichever marks are used it must be remembered that Point Paper is not a general representation of the design but is a specified plan of the order of thread interlacing, and that each square is the point of intersection of a warp end and a weft pick. To interlace, the threads must cross each other and therefore in one complete repeat of a design there must be at least one mark and at least one blank in every vertical space and every horizontal space. Otherwise the threads will not interlace and merely form loose floats which do not become woven into the fabric (Fig 6.3).

Fig 6.6: Wrong Design - Warp 1 and Warp 5 are forming loose floats

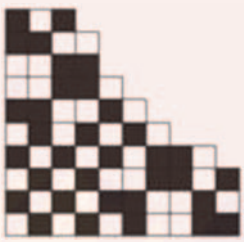


Fig 6.7: Faulty Repeat Unit - one complete repeat must be in a rectangular form

Any weave repeats on a definite number of ends and picks. Generally, one repeat unit is indicated on the design paper. The ends and pick in a repeating unit may be equal or unequal but a complete repeat must be in a rectangular form as the threads interlace at right angle. (Fig: 6.7). If a repeat unit extends over 8 ends and 8 picks, every portion must extend over 8 ends and 8 picks. It is necessary for marks and blanks to join correctly at all the sides of a design, as when the pattern repeats to make a cloth, an unbroken weave results. An incomplete repeat or faulty repeat will result in faulty construction of a fabric.

However, a weave can start from different positions, as this does not affect the appearance of the fabric, although one repeat may appear to look different. (Fig 6.8a and 6.8b)

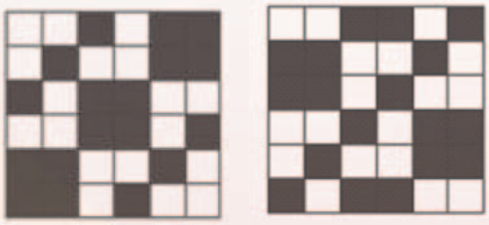


Fig: 6.8a Fig: 6.8b

Same weave but the starting position is different

6.3. CONSTRUCTION OF DRAFTS AND PEG PLANS

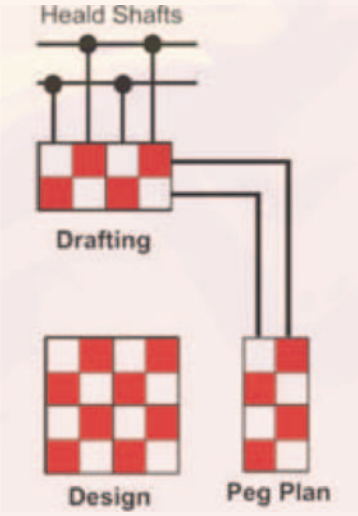


Fig 6.9: Design, Draft and Peg Plan

A Draft indicates the number of Heald Shafts to be used to produce a given design and the order in which the warp ends are to be threaded through the heald eyes of the healds.

There are various methods for indicating the draft but the most common and convenient method is the use of design paper. In this method the draft is drawn exactly over the design and the horizontal spaces represent the healds and the vertical space indicates each corresponding warp end (Fig.: 6.9).

The principle of drafting a pattern is that all the ends working in different orders require separate heald shafts. This means that as a heald shaft is an entity, therefore all the ends passing through a given heald shaft will work alike. The converse of this rule may not always be true as occasionally for convenience and better performance the ends that are working alike are passed through different healds. It may be noted that number of picks in a repeat is of no consequence for a drafting pattern, this will be considered in Lifting Plan.

The Lifting Plan or the Peg Plan defines the selection of heald shafts to be raised or lowered on each successive insertion of pick.

The peg plan is drawn alongside the design. The numbered vertical spaces of the peg plan correspond with the numbered heald shafts in the draft and the number of horizontal spaces is equal to the picks in the design. The vertical space 1 in the peg plan indicates how the first heald will be operated; the numbered 2, the second heald and so on. The plan further shows which heald shafts will be raised and lowered on successive picks. Thus the diagram indicated that on first pick the healds 1 is raised and 2 are lowered; on second pick heald 2 is raised and heald 1 is lowered; on third pick again healds 1 is raised and 2 are lowered and on fourth pick heald 2 is raised and 1 is lowered.

6.4. METHOD OF CONSTRUCTION

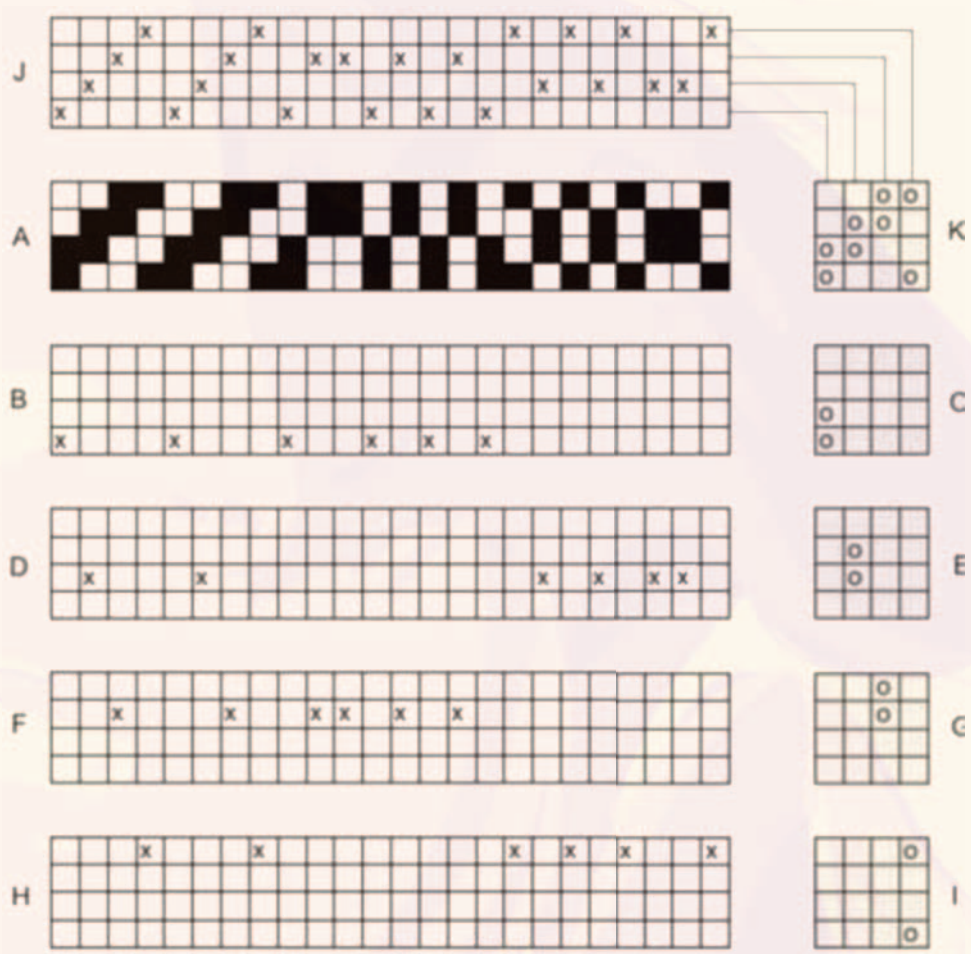


Fig 6.10: Step by step Method of Constructing Draft and Peg Plan from the given Design

The draft is constructed by following rule:

- All the ends in a design which work alike are drawn through the same heald shaft
- The ends which are working differently from each other are drawn on different healds.
- Therefore, the number of heald shafts required in a repeat of a design is equal to the threads in the design that are working differently from each other.

Steps for constructing the Draft and Peg Plan for a Design:

- The first end is indicated on first heald,
- Then all the other ends that are working like first end are also indicated in First Heald (Fig 6.10B).
- The working of first heald is copied from the design to the 1st vertical space of the lifting plan (Fig 6.10C)
- The next end that works differently from the first end, is indicated on second heald
- Then the ends which work like this end are also indicated on the second heald (Fig 6.10D).
- The working of second heald is then copied from the design to the 2nd vertical space of the lifting plan (Fig 6.10E).
- The process is continued till all the ends in the design have been allocated heald shafts.
- The final draft and lifting plan for the given design is indicated at Fig 6.10J and Fig 6.10K respectively.

6.5. RELATION BETWEEN DESIGN, DRAFT AND PEG PLAN

The three factors upon which the construction of any woven fabric depends - Design, Draft and Peg Plan- are very closely related to one another and are interdependent. So it is very important to possess a thorough knowledge of these. If any of the 2 components are known then the third can be built. . Example, if one knows the draft and the peg plan then a Design can be made. If design and peg plan are known then a draft can be constructed.

6.6. TYPES OF DRAFTING

Various systems of drafting are used for weaving of fabrics. Some are common and hence very important to understand, while some are formed as a natural outcome of following the design or the lifting plan for which they are arranged, ex Herringbone or reversed draft .The common drafting systems are as follows:

6.6.1. Straight Draft -

Fig 6.11: Straight Draft

This is the most common and simplest system of drafting. In this drafting, successive ends in the repeat of a design are drawn upon successive healds until the end of the repeat is reached. Therefore, in this system the number of heald shafts required is equal to number of ends in the repeat. For the designs with straight draft, the lifting plan is always the same as design (Fig 6.11)

6.6.2. Skip Draft -

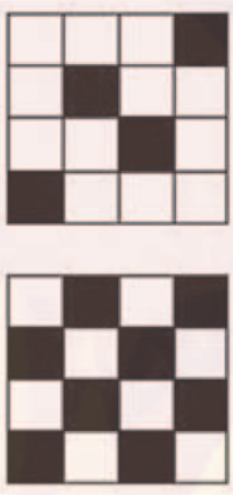


Fig 6.11: Skip Draft

This is used for weaves which are very dense. Normally, these weaves require very less heald shafts but to reduce friction and rubbing between the ends and to avoid crowding of mails on the shaft, Skip draft is used wherein more healds are used then minimum required. Example, Plain weave requires only 2 shafts, but can be drawn on 4 or 6 shafts (Fig. 6.11)

6.6.3. Point Draft-

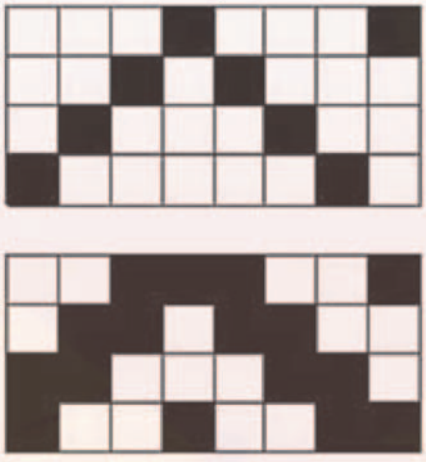


Fig 6.12: Point Draft

These are employed for weaves which are symmetrical about the center, example waved or diamond weave. Its advantage is that large effects can be produced on half the number of heald shafts than that required for straight draft (Fig. 6.12)

6.6.4. Sateen Draft -

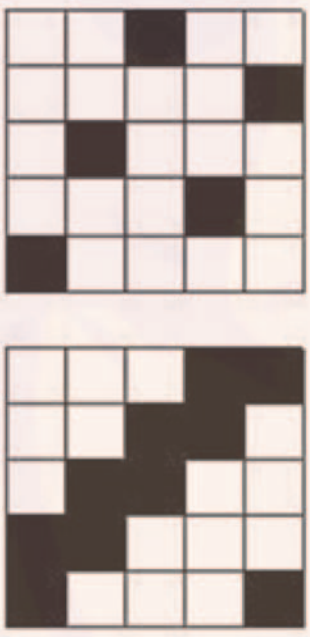


Fig 6.13: Sateen Draft

The purpose of this draft is the same as skip draft i.e. to reduce friction between adjacent warps and overcrowding. But in sateen draft this is achieved by staggering the placement of ends. (Fig.6.13)

6.7. DENTING

Fig 6.14: Two ways of representing Denting Pattern

The warp sheet is spread out across width of the loom. The desired density of the warp ends (Ends per inch) is achieved by choosing the right reed and different orders of denting. Order of denting is drawing the ends through split between the two wires in the reed. The most frequent used order of denting is one, two, three or four ends per dent. This can be regular or same across the width of the fabric or sometimes irregular to emphasis certain design features. The Denting pattern is usually indicated below the design as shown in Fig.6.14.

Summary:

The Weave Designing chapter will introduce the student to the actual designing of a fabric. The fabric is designed by the warp and weft interlacing with each other in different ways. Each class of structure that is produced is called a Design. This chapter explains to the students in detail the process followed by a designer / weaver for designing of a fabric on paper before it is actual taken for weaving on loom. It explains the method of fabric representation on paper. The students at the end of the chapter will be able to construct the designs and show its drafting pattern and peg plan.

Unit - 2 Assignment

I. Fill in the Blanks

1. The Winding Process removes the faults in the yarn, like _____ places and _____ places.
2. The process of converting yarn from single end package to a multiple end package is called _____.
3. The two ways of warping process are _____ warping and _____ warping.
4. In _____ warping, the ends of the yarn are wrapped in single operation from the yarn packages onto the warp beam.
5. Sizing of the warp yarn is essential to _____ breakage of the yarn and thus production stops on the weaving machine.
6. The woven structures with more than one series of warp and weft are called _____ Structures.
7. The order in which the warp threads are threaded in the dents of the reed is known as _____.
8. _____ part is related to the Shedding Mechanism.
9. The three basic operations in woven cloth production are _____, _____ and _____.
10. The _____ _____is defined as the number of ends and picks in a unit of a fabric.
11. The self-finished edges of the fabric are called _____.
12. Dobby Shedding Mechanism is capable of controlling up to _____ healds.
13. The Shedding Mechanism can be achieved in three ways _____ Shedding, _____ Shedding and _____ Shedding.
14. _____ determines the rate at which the warp is fed forward and the tension of the warp yarn.
15. The three factors upon which the construction of any woven fabric depends are _____, _____ and _____.

II. True or False

1. Yarn Singeing is a compulsory process for fabric manufacturing.
2. After winding the overall strength of the yarn increases which causes less yarn breakage during weaving.
3. Weft yarns also require the Sizing Process.
4. All the ends in a design which work alike are drawn through different heald shafts.
5. Indirect Warping Process would be employed to make warp for Striped Shirt Fabric.
6. Reed Count is defined as number of dents in two inches.
7. Straight Draft isemployed for weaves which are symmetrical about the center, example waved or diamond weave.
8. Drafting defines the selection of heald shafts to be raised or lowered on each successive insertion of pick.
9. A mark in this square of a Design Paper indicates "Warp over weft".
10. Picking can be done before Shedding.

III. Select the Correct Answer from the options given below (MCQs):

1. The "Pirning" process is need in
   a. Handloom
   b. Rapier
   c. Projectile
   d. Airjet
2. The Sizing Process is done after
   a. Winding
   b. Drawing-In
   c. Warping
   d. Creeling
3. The ends which are working differently from each other are drawn on _____ healds.
   a. Different
   b. Same
   c. Common
   d. Similar

4. The process of removing the size paste from the fabric after weaving is called

   a. Resizing

   b. Sizing

   c. Degumming

   d. Desizing

5. The metallic comb made up of wires,which also determines the fabric density, is called

   a. Heald Wire

   b. Reed

   c. Density meter

   d. Comber

6. The _____ Motion can be described as the heart of weaving as it is here that the nature of the interlacing or the weave is decided.

   a. Picking

   b. Beating

   c. Shedding

   d. Warp Let-Off

7. To get the required warp density

   a. Number of Heald Shafts are varied

   b. More warp beams are used

   c. Let Off Speed is increased

   d. Reeds of different counts are used.

8. The Drafting system in which the number of heald shafts required is equal to number of ends in the repeat is

   a. Skip Draft

   b. Sateen Draft

   c. Pointed Draft

   d. Straight Draft

9. The common method used for design depiction is

   a. Design Paper

   b. Graph Paper

c. Drawing Paper

d. Brown Paper

10. a large metallic frame on which yarn packages are placed is known as

a. Yarn Stand

b. Iron Frame

c. Creel

d. Package Holder

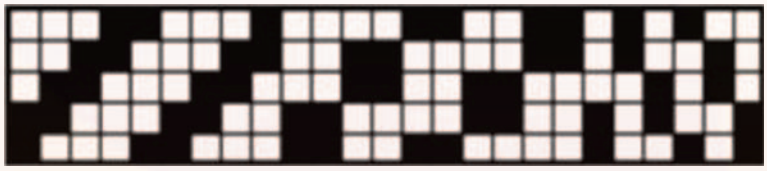
IV. Define the Following terms:

1. Indirect Warping
2. Reed Count
3. Design, Draft and Peg Plan
4. Straight Draft
5. Shedding
6. Picking
7. Beating
8. Heald Shaft
9. Yarn Preparatory
10. EPI and PPI

V. Answer the following the Questions:

1. Explain the passage of yarn on the loom with diagram.
2. Explain the Yarn Preparatory Process with the help of a Flow Diagram.
3. Write a short note on "Basic Operations in Woven Cloth Production".
4. Describe the steps in construction of Draft and Peg Plan for a given Design.
5. What is the total number of Ends in a 45" wide fabric, if the EPI of the fabric is 96?
6. The weaver is using a reed of 32s Reed Count to weave an 8" wide fabric. If he puts 4 ends per dent then what is the EPI of the fabric and the total number of ends in the fabric?
7. What are the various Drafting Systems? Explain with diagrams.

8. Draw Draft and Peg plan for the following Design.



9. Write a short note on "Shedding Mechanism".

10. What is denting?

11. Enumerate the uses of Heald Shaft and Reed.

Unit - 3

Fabric Structure

Chapter - 7:
Introduction to Weave Structures

7.1 FABRIC STRUCTURE

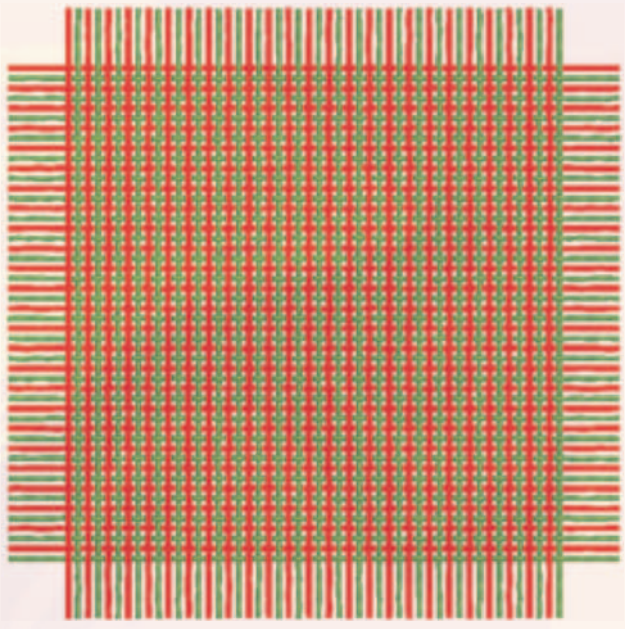


Figure: 7.1

Fabric refers to any material made through weaving, knitting, crocheting, braiding or bonding which may be used in production of any end use product such as garments. When a material is constructed using any textile fibre into 2 dimensional or 3 dimensional structures which may be drape-able, spreadable and pliable, it is called a **Fabric (Fig 7.1)**. It can be wearable, useable as any functional product in an interior or exterior, as home furnishing, or may be used as an aesthetic piece of art. A fabric is a flexible woven or non woven material consisting of natural or artificial fibers known as thread or yarn. A Yarn is produced by spinning raw fibers of cotton, silk, wool, flax, or other materials to produce continuous long strands.

A Textile fabric is formed by weaving, knitting, crocheting, knotting, or pressing fibres together known as felted fabrics. The term fabric and cloth is used in textile trades such as tailoring and dressmaking as synonyms for textile. A Cloth may be used synonymously with fabric but often refers to a finished piece of product used for a specific purpose e.g., any fashionable garment, bed spread, bed cover, table cloth, curtains, durries and rugs **(Image-2)** etc.

Plain weave is extensively used in making the rugs and other hand woven Dhurry structure, one such example of a rug structure is given above

7.2 INTRODUCTION TO WEAVES

The weaves are represented graphically on a graph paper as explained in the earlier units. The type of weave used in a fabric depends upon the desired factors such textures, luster, strength, pattern, colours, look, feel, effects and cost of the production, before any recommendation of the weaves is done.

There are three basic weaves, they are:

- Plain weave,
- Twill weave, and
- Sateen and stain weave

All other weaves are the permutations and combinations of these weaves only irrespective of whether they are produced on handloom, power loom, on a simple treadle loom, on a multi treadle frame loom, on a loom using dobby or on a loom attached with a Jacquard wherein an elaborate design with the application of one or multiple weaves are employed (Image-3).

An example of simple yet elaborate design woven using the Jacquard mechanism

Summary:

This chapter introduces the student to the fabric structures. The type of weave used in a fabric depends upon the desired factors such texture, luster, strength, pattern, colour, look, feel, effects and cost of the production, before any recommendation of the weaves is done. This chapter in brief gave an idea to the students about the various fabric structures that they are going to study in the forthcoming chapters. The three basic structures are Plain, Twill and Sateen Weave. All other weaves are the usually a permutations and combinations of these weaves.

Chapter- 8:
Introduction to Plain Weave

8.1 PLAIN WEAVE

Characteristics of Plain weave

It is the most economical and easy to produce weave. In a plain weave, each warp yarn passes alternatively over one weft and then under the second weft yarn. They require only two heald shafts or harnesses because the weave repeats every two ends and two picks. When one heald shaft is raised the other is lowered, and then the sequence is reversed for the next pick. **Please refer figure 4 and 5.**

INTERLACMENT OF WARP & WEFT

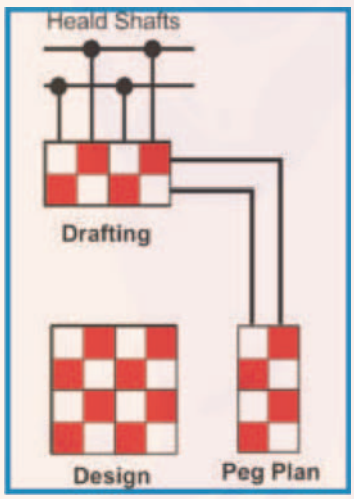


Figure 4

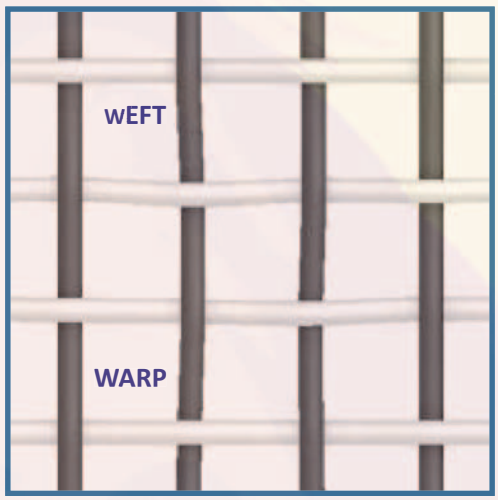


Figure 5

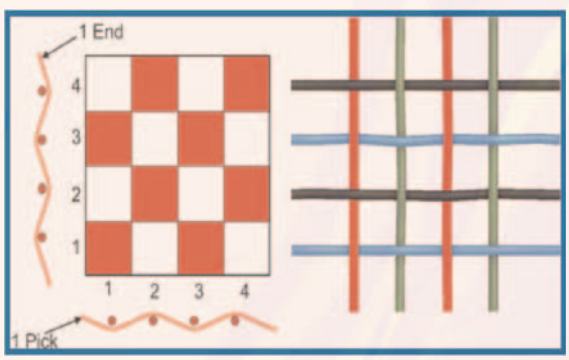


Figure 6

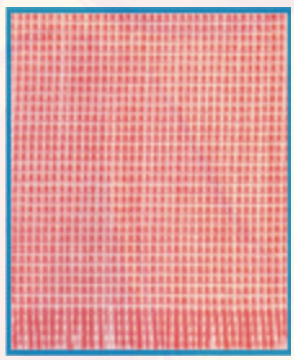


Figure 7

The simplest and most elementary combination of two series of threads employed in in the construction of textile fabrics is the **plain** weave or also termed as **calico weave (refer figure 6 and 7)**. In figure 6 the fabrics depicts two colors warp series and weft series in 1:1 order.

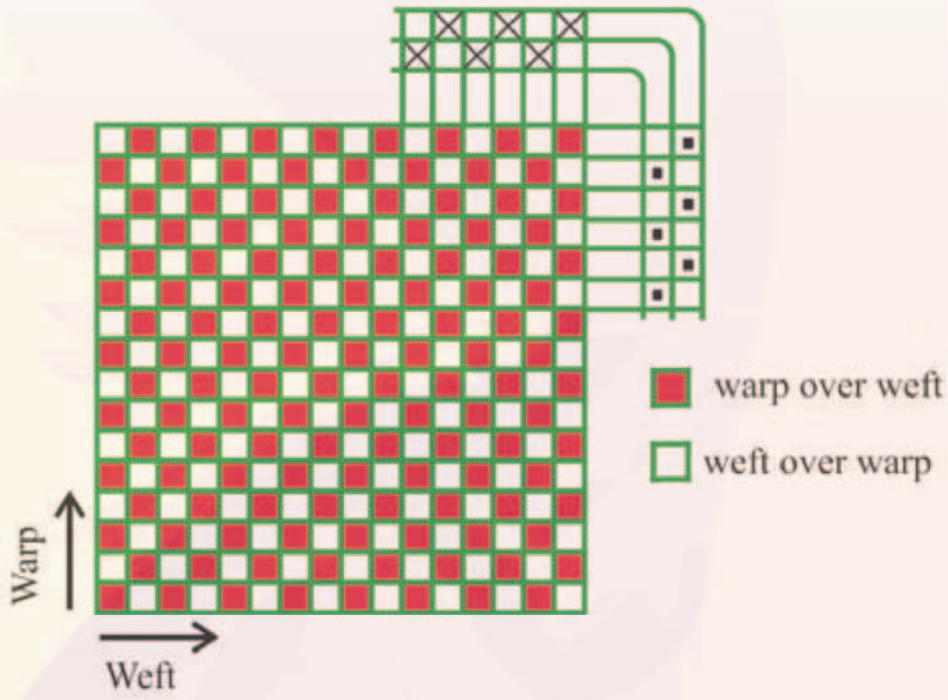


Figure - 9

Illustration shows Warp up (over weft) and weft up (over the warp) the manner in which it can be represented on a graph paper.

Plain weave is the most widely used of all fabric structures and has the simplest possible pattern of interlacing, the pattern actually repeating itself on every ends and picks **(figure-8)**. It also has the maximum possible frequency of interlacing, thereby producing a fabric of firm structure. The yarns in this weave are not easily displaced and are more resistant to slipping.

The interlacement of warp and weft can also be closely examined in the ***figure-9*** wherein both naturalistic and semi naturalistic form of drawing illustrate the interlacements of warp and weft shown with the selvedge interlacements in a fabric construction.

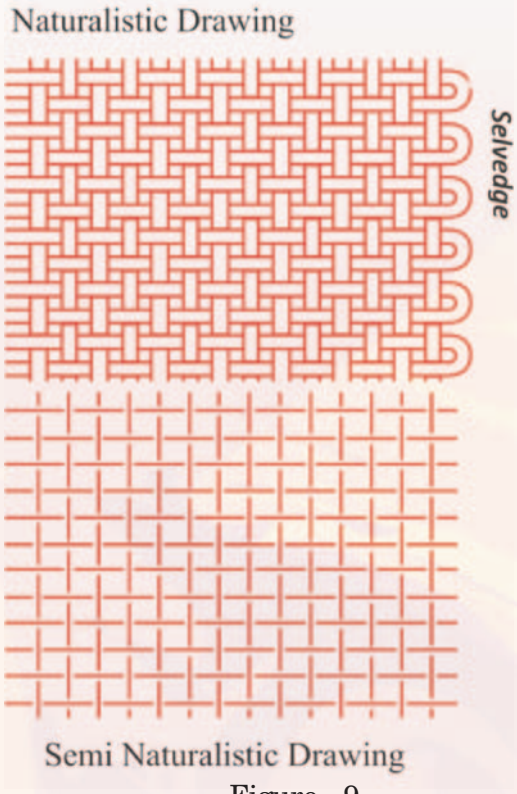
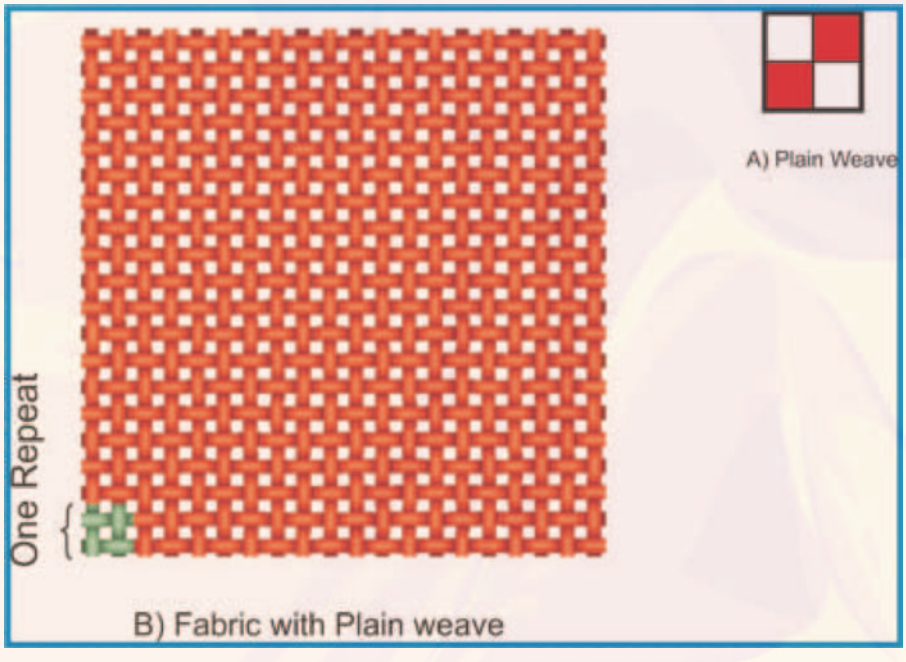


Figure - 9

Illustration above shows the interlacement of warp and weft along with the selvedge at one side of the construction in natural and semi naturalistic way.



8.2 DERIVATIVES OF PLAIN WEAVE:

Plain weave has the simplest form of interlacing and many variations of weaves could be produced from the simple plain weave by extending it either horizontally, vertically or both, they are termed **as derivatives of plain weave**.

The following are the derivatives of the plain weave which could be further modified in terms of the ratios of the warp and weft inserted during the course of weaving. Depending upon it's ratio between warp and weft selected they may be called regular warp or weft rib or irregular warp or weft rib, similarly regular matt or irregular matt weave depending upon the ratios of warp and weft is selected for the construction of the weave.

8.2.1 Warp Rib

The Warp rib weaves are constructed in which each end passes alternately over and under two or more than two picks. Effect of the warp rib can be seen prominently from both the sides of the fabric.

Figure - 10

2 x 1 warp rib, the rib effect is produced in weft direction

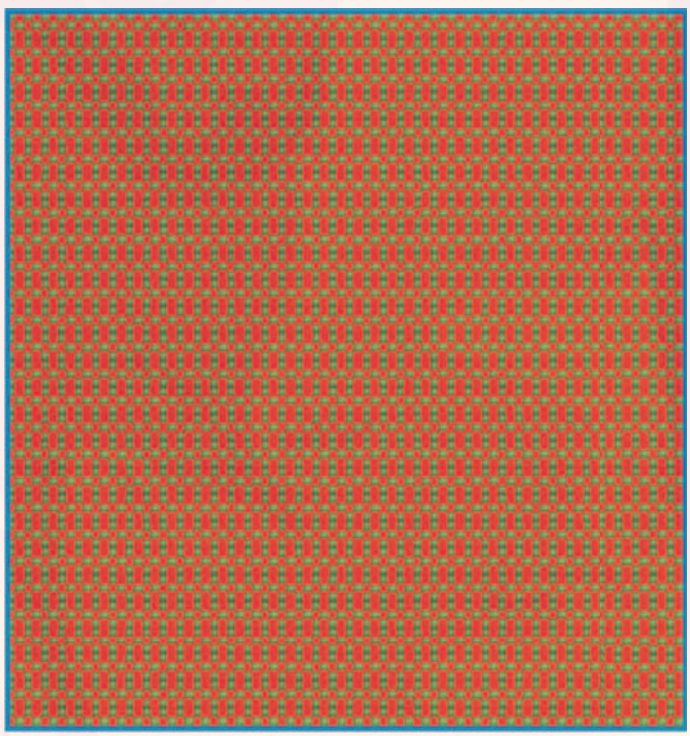


Figure - 10A

When the two picks are inserted between formations of a shed (with single warp up) then 2 x 2 warp rib is produced (refer the **figure 10A**) . Likewise, if 3 picks or 4 picks are inserted in the same shed then 3 x 3 warp rib or 4 x 4 warp rib is formed. The warp rib can be identified by the fact that the formation of the rib is always in weft direct which can be seen very prominently. **Please see figure-10 & 10A.**

8.2.2 Weft Rib

The Weft rib weaves are constructed in which each end passes alternately over and under two or more than two ends. When the 2 ends are lifted alternately the result would be 2 x 2 weft rib. If the lifting is done by 3 ends and 4 ends the resultant weaves would be 3 x 3 and 4 x 4 weft rib respectively. The weft rib can be identified by the fact that the formation of the rib is always in warp direct which can be seen very prominently.

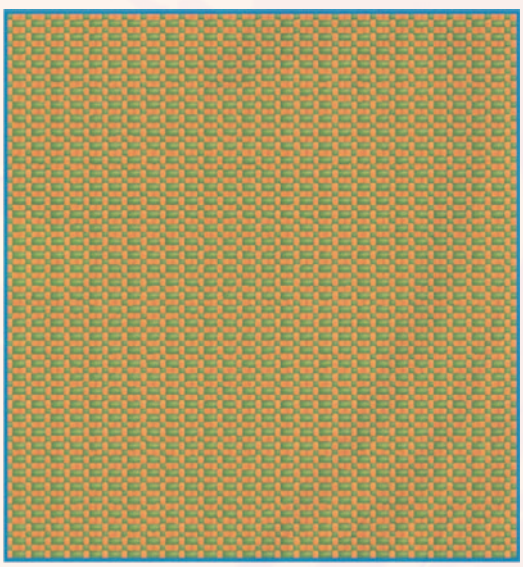


Figure - 11

2 x 1 weft rib, the rib effect is warp direction

During the weaving, the warp rib or weft rib effect can be obtained by using one thick pick or one coarse end instead of two or more picks in a shed or two ends taken up in single eye of the drafting in the heald shaft during weaving as one respectively. ***Please see figure-11 & 11 A.***

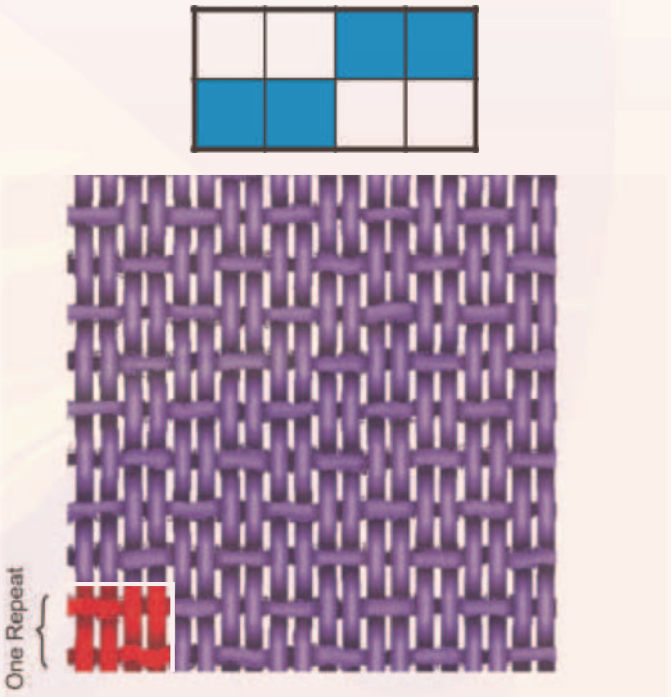
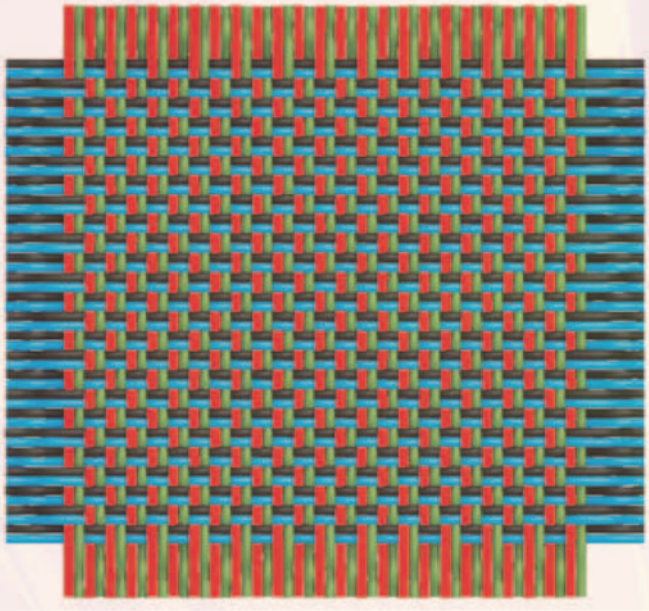


Figure - 11A

8.2.3 Matt or Hopsack or Basket weave:

Figure - 12A



Matt weave is also the most popular weave as one of the derivatives of plain weave in the textile industry. They are made by extending a plain

weave structure both warp way and weft direction. If the two or more ends working as one single ends and two or more picks in a shed then a Matt weave is produced. The simplest and most commonly used weave is ***2 x 2 Matt*** also known as ***Basket*** or ***Hopsack*** weave as depicted in ***figure-12 A & B***. Grouping of the yarns in an irregular manner in warp direction or weft direction will produce the effects that are known as irregular Matt weave. Similarly 3 x 3, 4x 4 or more Matt weaves can be constructed.

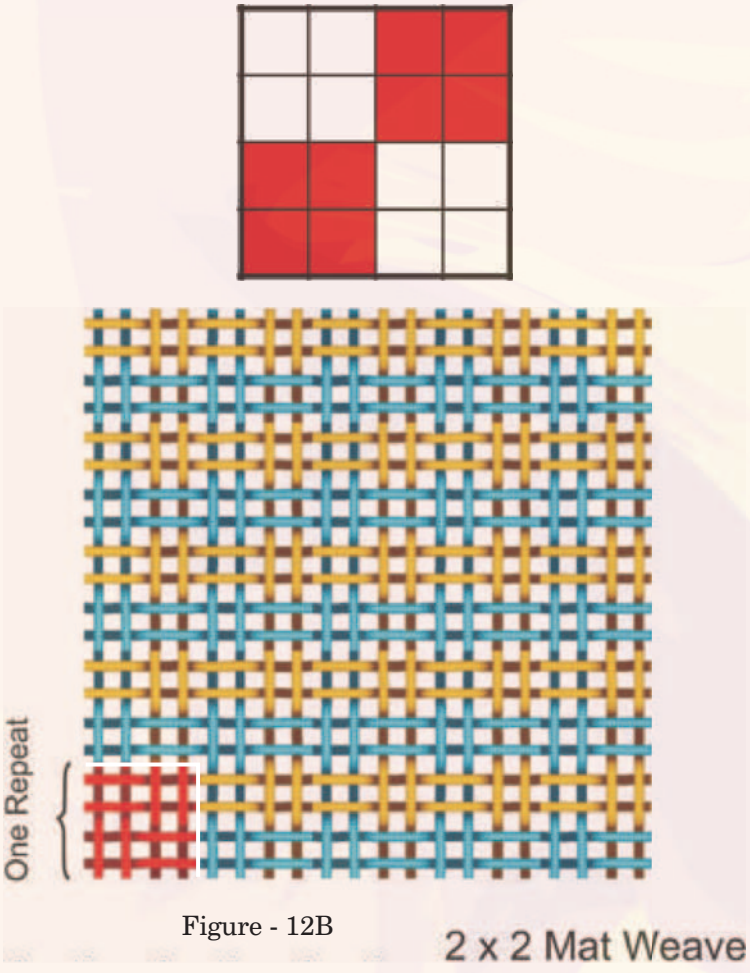


Figure - 12B

Summary:

This chapter introduces the Plain Weave Design. The plain weave is most economical and easy to produce. Different fabrics are made with plain weave, just by changing the yarn count and varying the construction. Different patterns can also be achieved by using coloured yarn. In this chapter the students will learn the ways of representing the Plain weave on the Design paper. This chapter will also introduce the student to Derivatives of Plain Weave. These can be made by simple modifications in the Plain Weave. At the end of the chapter the student will be ready for weaving the Plain Weave Swatch.

Chapter- 9 :

Introduction to Twill Weaves

Twill weaves can easily be identified by its general characteristic of more or less pronounced diagonal lines in either warp or weft direction. The most commonly known twill is the Denim fabric.

9.1 CHARACTERISTIC OF TWILL WEAVES

Twill weaves can easily be identified by its general characteristic with its series of more or less pronounced diagonal lines in either warp or weft direction, or in equal or quantities on both sides of the cloth. Twill with 3 ends and 3 picks with lifting of 1 /2 twill or 2/1 twill ***figure-13*** is the smallest twill weave repeats. The twill lines can be made continuously either from left to right in / direction as shown in ***figure 14*** and is called ***Right Hand Twill*** or ***Z Twill*** and a twill which runs from right to left in \ direction as shown in ***figure 15*** and is called ***Left Hand Twill*** or ***S Twill***.

Figure - 13

Figure-14: Right Hand Twill

Figure-15: Left Hand Twill

These weaves can be again sub-divided as follows.

9.2 BALANCED TWILLS AND UN-BALANCED TWILLS

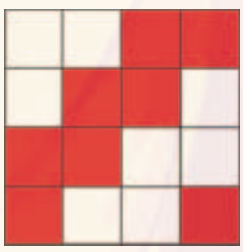


Figure-16

In a **Balanced twill (figure 16)** the number, size and distribution of the warp or the weft floats are similar, and whereas in **Un-balanced (figure 17)** twill either warp or the weft floats may be very prominent.

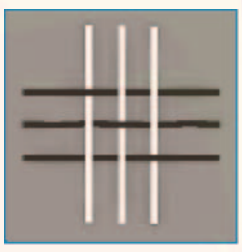
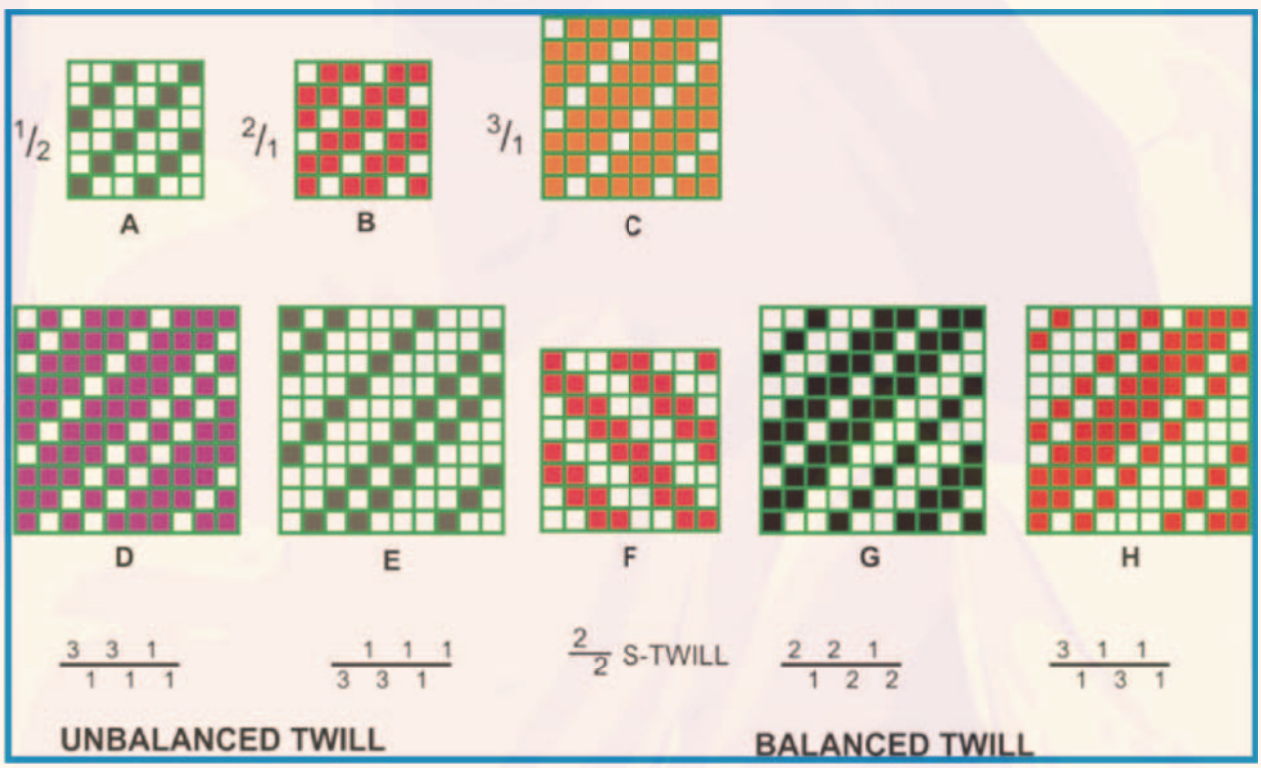


Figure-17

The basic principle of the construction of twill weave is that the float of each warp or weft thread may move upward or outward in one or sometimes more than one warp or weft direction that may be lifted up respectively to the right or left depending upon the required direction of twill of the preceding warp direction up or weft direction up. For instance, the 3-ends ½ twill running to the right as shown in **figure-18 A**, the first warp thread is over the first weft thread, and then second warp thread is raised over the second weft thread, the third over the third etc. i.e., each weft float is one warp thread to the right of the float of the preceding pick. In this progressive order of interlacement of the warp and weft, diagonal lines are formed. This type of twill is known as 1 up 2 down (1/ 2 twill) which indicates every pick has to pass under one warp and go over two and so on, thereby making a weft float fabric on the face side. Likewise other twill like 2/1 & 3/1 can be constructed, wherein warp will be more prominent on the face of the fabric **(figures-18 B & C)**. Prominence of the twill lines can be seen on both the sides of the fabric. Direction of the lines on one side is opposite to that seen on the other when the fabric is turned on the back side. There are other class of twill weaves derived from the basic twills known as Regular twills, Steep Twill, Flat and Elongated twills, Combination of twills, Broken twills, Pointed twill, Wavy or Zigzag twill, Herringbone twill, and Fancy twill weaves. A 3 ends twill with 2/1 lifting is represented in **Fig 18**-with its naturalistic interlacement for easy identification.



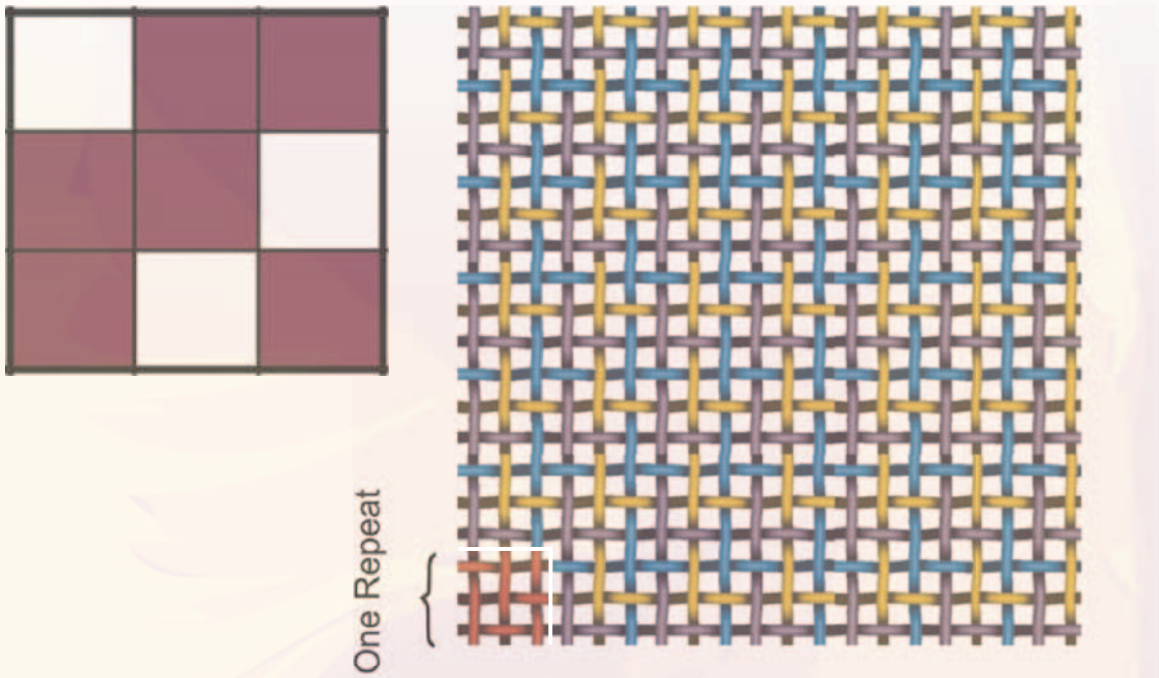


Figure - 18-1

9.3 REGULAR TWILLS

Regular twill is the simplest form of twill which can be constructed with equal or unequal diagonal lines of warp and weft arranged alternately. When the diagonal lines are equal, that is, if both ends and picks are lifted under the same number of warp and weft threads uniformly, warp and weft will definitely be in equal quantities on both the face and back of the fabric, but if the lines are unequal, warp and weft may be either in equal or in unequal quantities on the face and back of the fabric. They may be either termed as warp faced or a weft-faced twill fabric depending upon the predominance of the warp or weft floats on the face of the woven fabric.

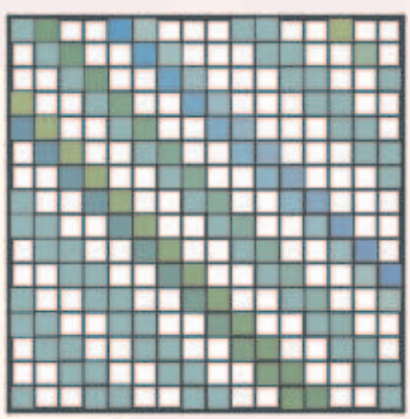


Figure - 19 A, 2/2 Twill

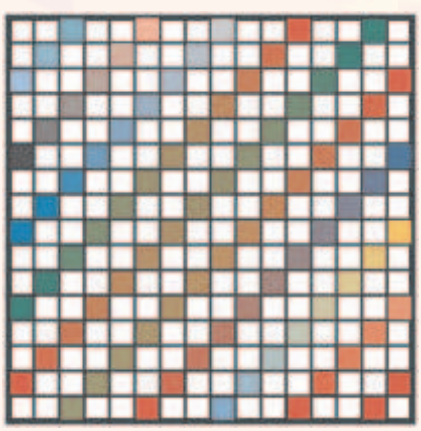


Figure - 19 B, ½ Twill

Chapter- 10:
Introduction to Sateen and Satin

The Sateen fabric has a characteristic lustre, sheen on the surface. This chapter introduces the Sateen Weave Design. It will teach the students the ways of representing the same on the Design paper. The production of Sateen requires certain rules. The chapter will introduce the students to these rules. It will teach them to make various regular and irregular structures of Sateen. At the end of the chapter the student will be ready for weaving the Sateen and Satin Weave swatch.

10.1 CONSTRUCTION AND CHARACTERISTICS OF SATEEN /SATIN WEAVE

A sateen weave is predominantly a weft faced weave, whereas satin is a warp dominant fabric. It is constructed by choosing a move number. Selection of move number (intervals of selection) depends upon various factors to get a regular sateen and satin.

Principles of construction of sateen and satin are dependent upon the following rules:

1. A move number selected should not be less one of a repeat size.
2. A move number cannot be allotted as one move.
3. A move number should not be divisible by the number of ends and picks in a repeat.
4. A move number cannot be half of the number of a repeat size

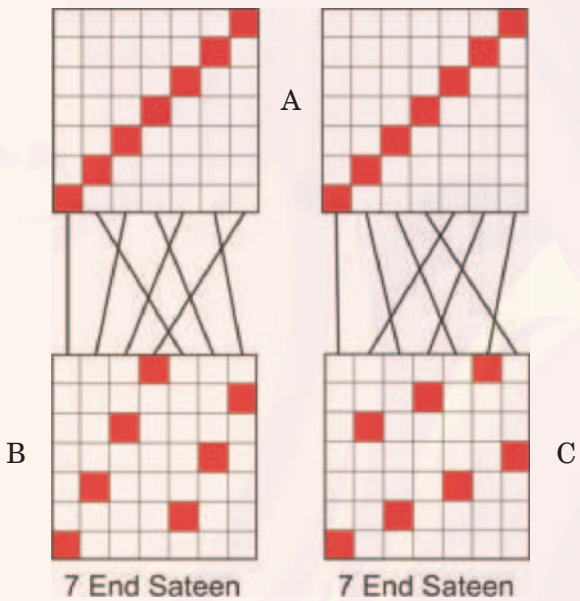


Figure - 20

7 end Sateen at 2 and 5 intervals

A Sateen weave when re-arranged can be made into twill, likewise a twill weave can be rearranged and converted into a sateen weave (weft face satin)

The simplest system of rearranging ordinary continuous twill weaves produces a class of weaves known as '**satin**' **or** '**sateen**' **weaves**. These sateen or satin weaves are characterized by an even and smooth surface of either warp or weft, resulting from a perfectly regular distribution of intersection of those threads.

In the **Figure-20B a 7-end weft faced satin (sateen)** weave is produced from 7-end weft faced twill **(Figure-20A)** by re-arrangement. Exactly reverse of this is when sateen is converted into warp faced and is called **Satin weave**. The interval of selection for re-arrangement may be either of two complementary numbers whose sum equals the whole number, but which have no common measure. Therefore, for 7-end sateen the interval of selection might be 5 and 2 or 4 and 3. **In Figure-B** the interval of selection is 4 and in **Figure-20C** it is 2. Similarly, sateen weaves of higher number of ends per repeat can be constructed by-arranging ordinary twills.

If we reverse the selection in sateen as given above by following the principles of same construction, we will get satin weave which is a warp dominant weave. **In figure 21** the examples of **7 ends satin** with 2, 3 4 and 5 moves and **10 ends satin** is given with 3 and 7 moves.

1.

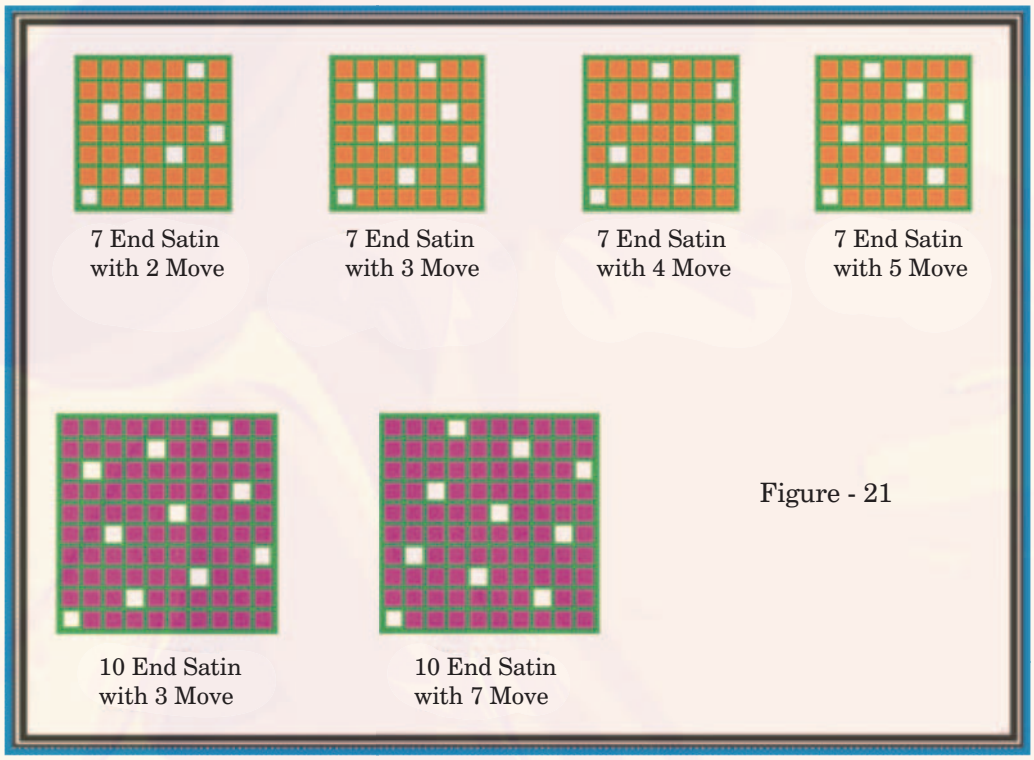


Figure - 21

Summary:

This chapter introduces the Twill Weave Design and its variations. It will teach the students the ways of representing the same on the Design paper and get them ready for weaving the Twill Weave Swatch. The twill weave can be sub-divided in many ways. Each class will produce different types of twill lines. It will also give different effects.

Assignment

1. Take any colour paper/newspaper with or without image cut them in vertical and horizontal direction. Create interesting woven textures by using these as warp and weft by interlacing them in different order. Please refer the woven structure as taught to you.

2. **Answer the following questions**

Q.1. Define the term fabric?

Q.2. What are the basic weaves?

Q.3. what is mean by interlacement, illustrate with an appropriate diagram?

Q.4. Classify the derivatives of plain weave?

Q.5. How to identify a twill weave?

Q.6. How to differentiate between sateen and satin?

3. **Fill Up the blank.**

1. All vertical series in a textile weaving is termed as ……and is also known as ……..
2. Plain weave with 2 threads in warp and 2 threads in weft is also known as……..weave.
3. Twill fabric can be recognized by its……..lines
4. ……..is a fabric with warp dominant structure.
5. A fabric formed by……of……..and……..

4. **Choose the correct answer from the given options.**

1. 2/2 twill is an example of a
   a) Unbiased twill
   b) Biased twill
   c) Unbalanced twill
   d) Balanced twill
2. Sateen is a weave where
   a) Warp is more dominant
   b) Both warp and weft is equal

c) Weft is more dominant

d) It produces diagonal lines

3. In warp rib the rib formation is in

a) Warp direction

b) Both warp and weft direction

c) Weft direction

d) None of the above

4. 2 x 2 Mat weave is a

a) a derivatives of satin weave

b) a derivatives of twill weave

c) a derivatives of plain weave.

d) Balanced twill

5. Left hand twill is also known as

a) "Z" twill

b) "S " twill

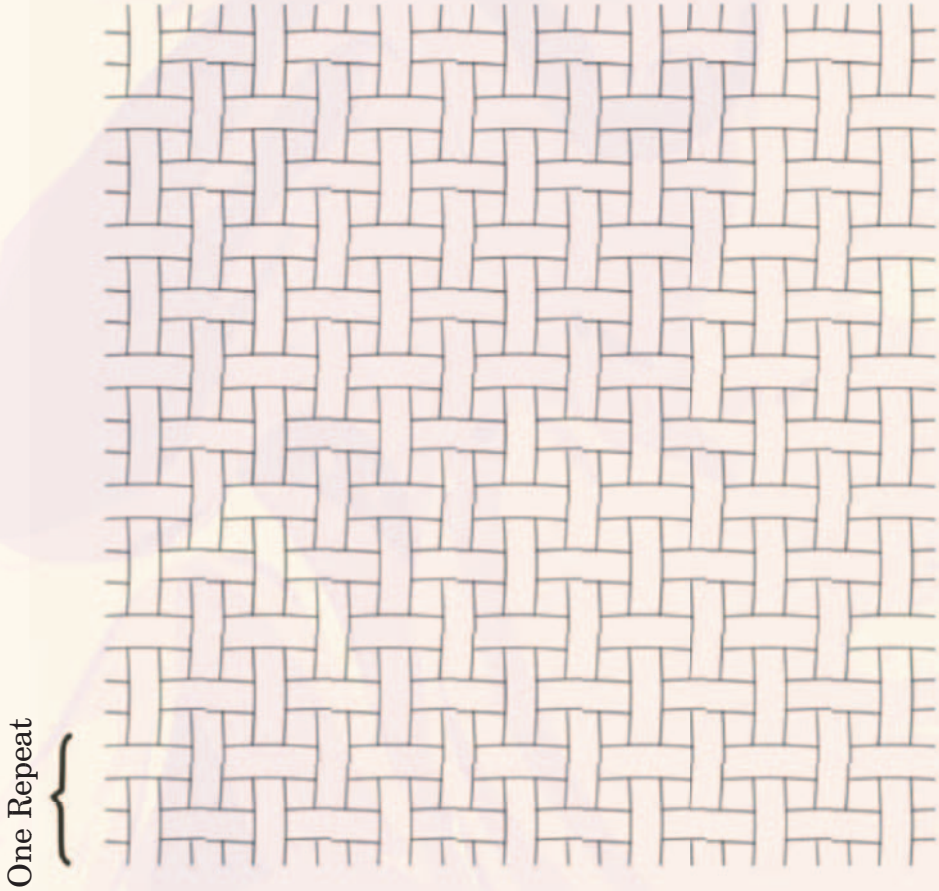
c) Upward twill

d) Downward twill

EXERCISES

Exercise 1:

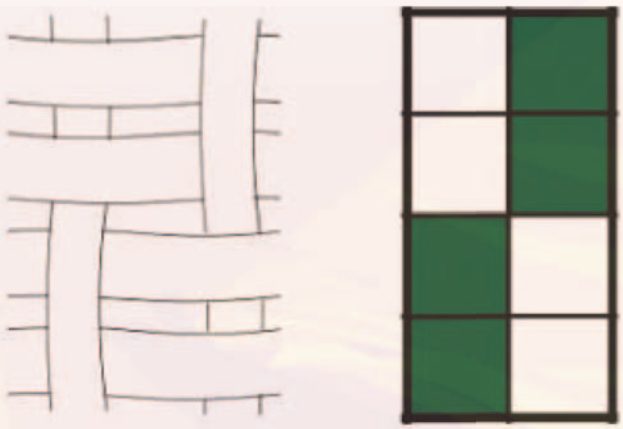
Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.

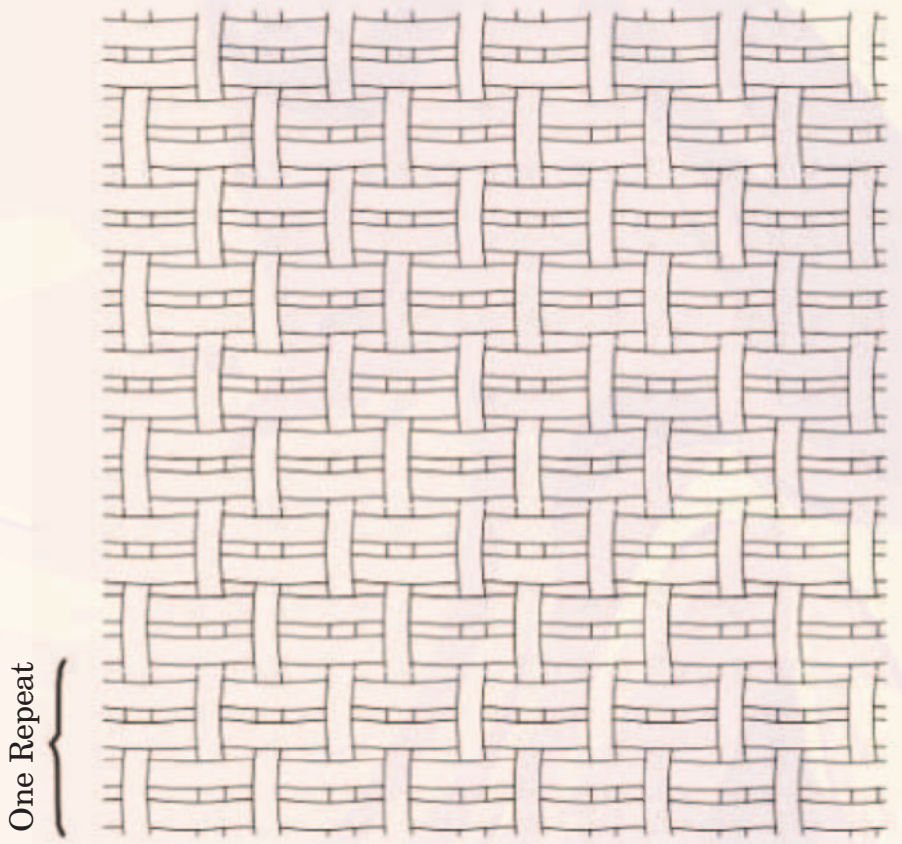


Plain Weave

Exercise 2:

Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.

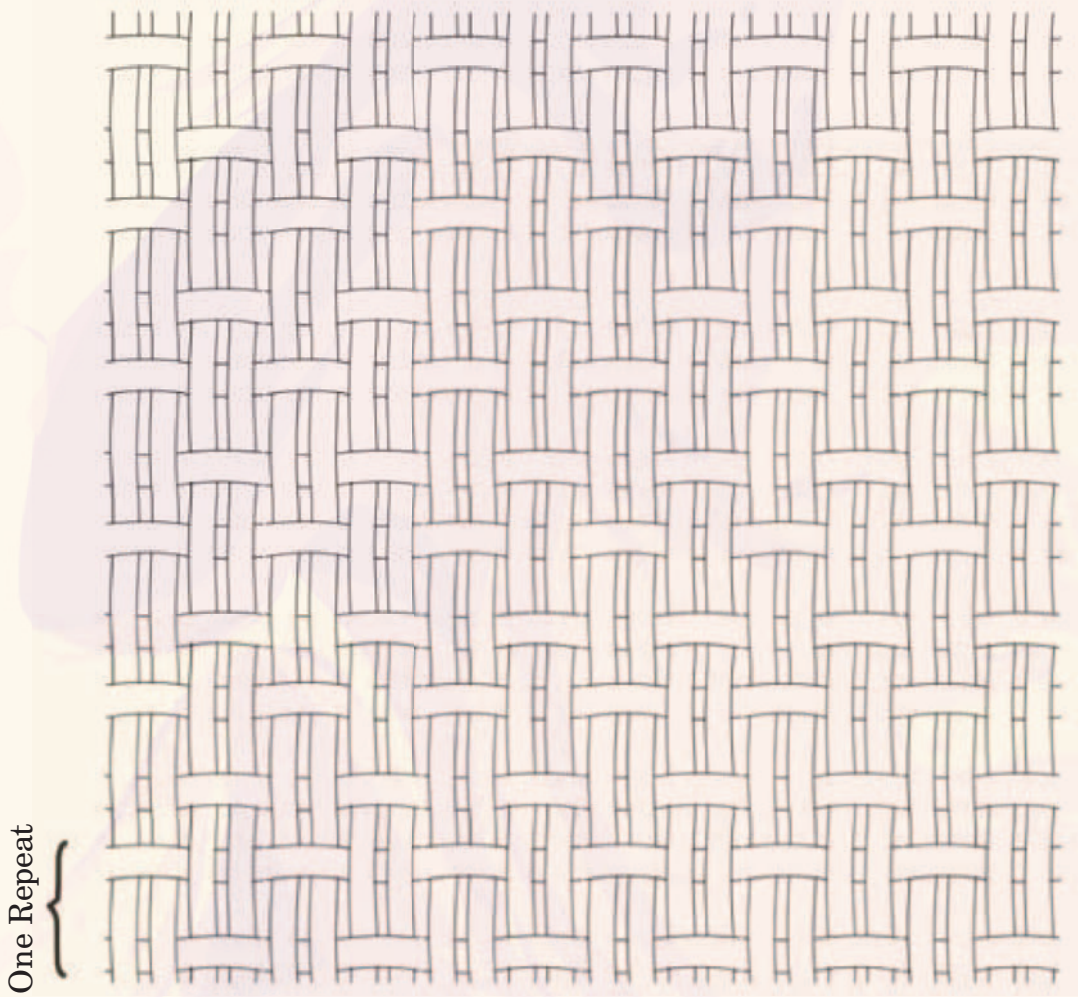




Warp Rib Weave

Exercise 3:

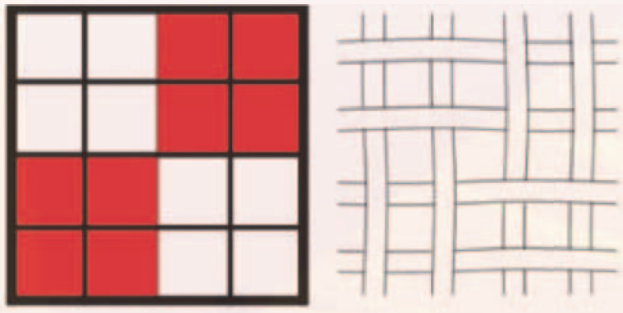
Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.

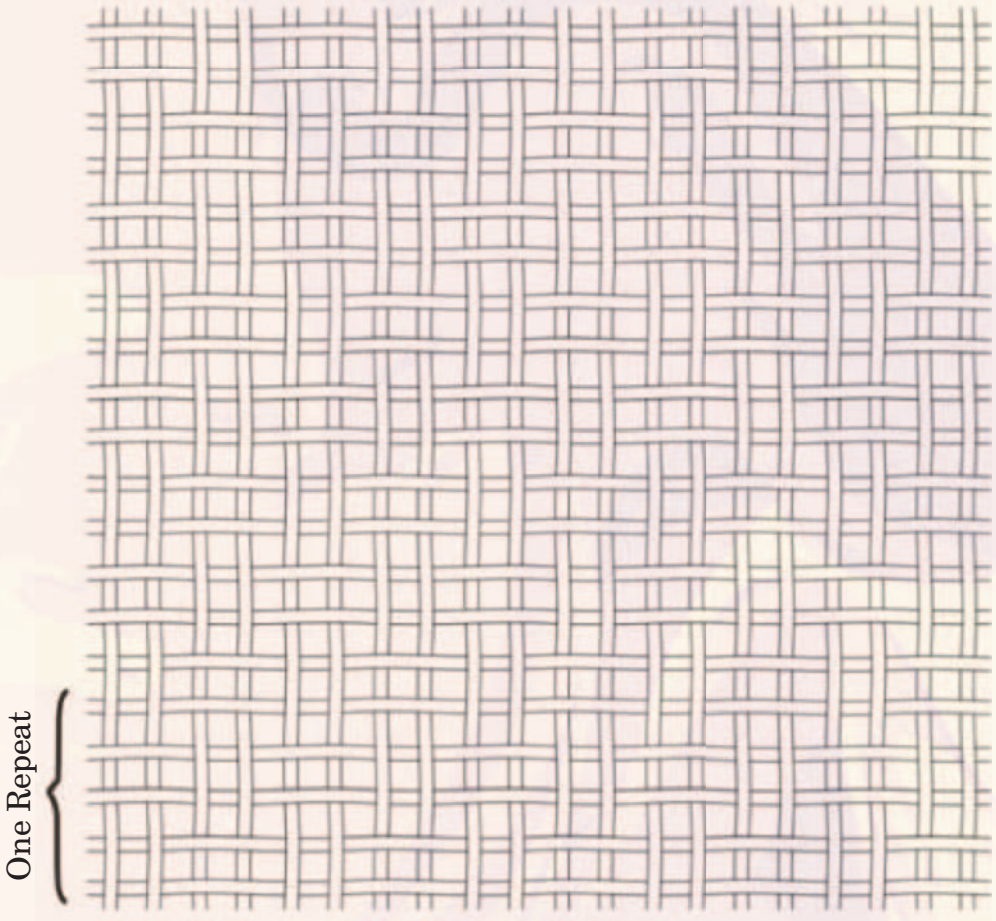


Weft Rib Weave

Exercise 4:

Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.

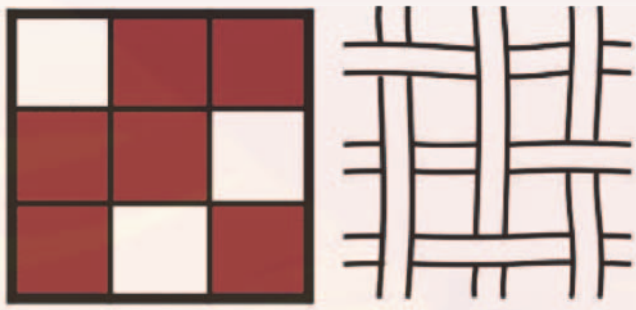


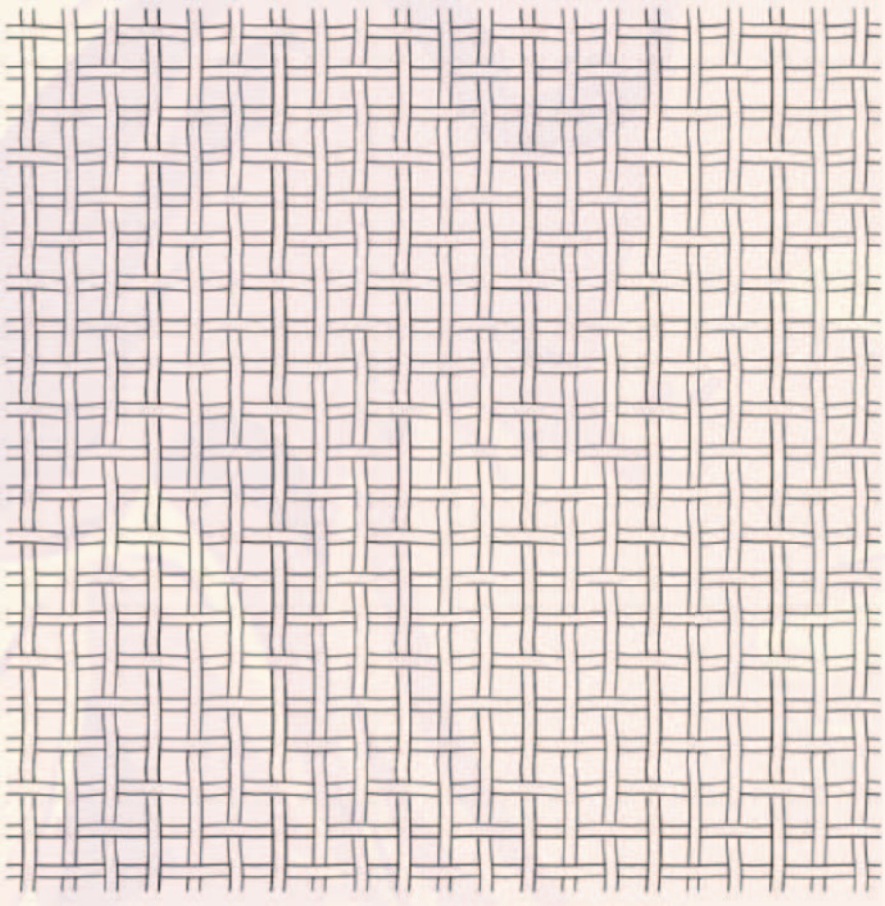


Mat Weave

Exercise 5:

Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.

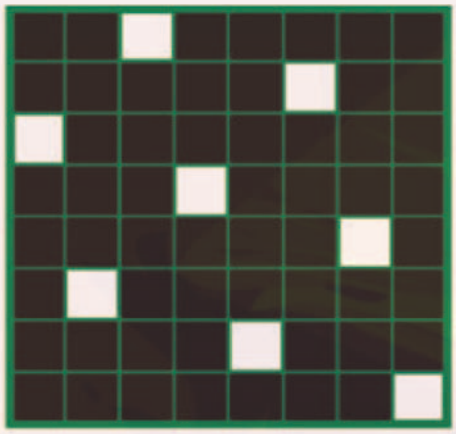


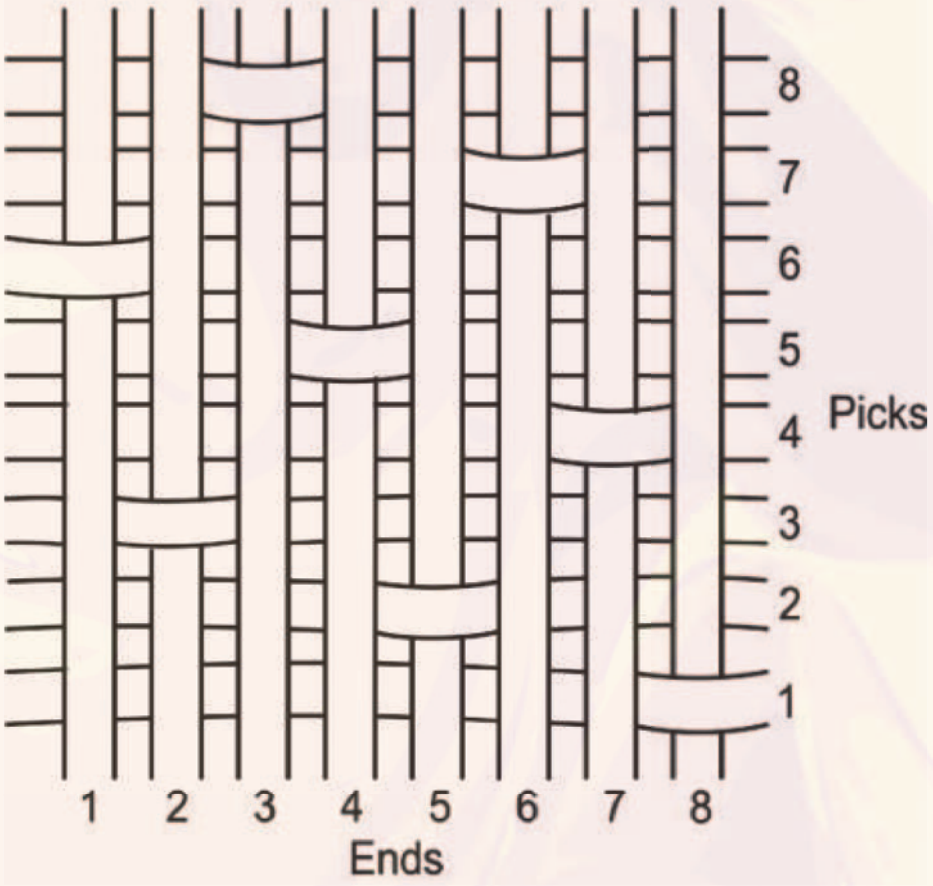


3 Ends Twill Weave

Exercise 6:

Take any two contrasting colour sketch pen, fill the vertical segments with one colour and horizontal segments with the other colour in the following weave and examine the interlacements of the two elements warp and weft.





8 End Satin Weave

Unit - 4

The Commercial Aspect

Chapter- 11:
An Overview of Textile Industry

11.1 INTRODUCTION

Textile industry in India is providing to one of the most basic needs of people and therefore holds importance with sustained growth for improving quality of life. India is rich in terms of raw material and hence has the ability to deliver the finished products with higher and substantial amount of value addition at every level of production. Indian textile industry is just next to agriculture in terms of employment generation and size of the industry. It accounts for about 12-13% of producing value added articles and contributes for about 1/3rd of gross exports earnings.

Textile industry produces a large variety of products, ranging from apparel, home furnishings, upholsteries, carpet to floor coverings. *Products like high fashion fabrics, designer's garments, and home fashion products like bed linens, kitchen linens, bath linens, beach linens, curtains and floor coverings are all available across Indian market* as shown in **Image 22-A**. Textile products are sold in domestic as well in overseas markets. Textile industry consists of both handlooms and Powerlooms. The Handloom industry has adopted various measures and techniques to provide high quality and eco-friendly products to the world market. Mills sectors and other organized sector have all upgraded in terms of technology. It has started using all high end machineries with the aid of digitization, electronics and computerization.

Image - 22 A

Examples of Home Fashion products like curtains, cushion covers, table cloth, aprons, napkins, and hand gloves are shown in the images above and below

Image - 22 B

11.2 SEGMENTS OF INDIAN TEXTILE INDUSTRY

Indian textile industry can be divided into following segments:

- **Cotton Textiles:** Second largest cotton and cellulosic fibres producing country in the world.
- **Silk Textiles:** India is the second largest producer of silk and contributes about 18% to the total world raw silk production.
- **Woollen Textiles:** India has 3rd largest sheep population in the world, having 6.15 crores sheep, producing 45 million kg of raw wool, and accounting for 3.1% of total world wool production. India ranks 6th amongst clean wool producer countries and 9th amongst greasy wool producers.
- **Man-Made Textile:** India is the fourth largest county in synthetic fibres/yarns globally.
- **Jute and Coir based Textiles:** India is the largest producer and second largest exporter of the jute goods. Image 23 indicates various segments of textile industries spread across all over India.

11.3 HANDLOOM AND POWER LOOM TEXTILE INDUSTRY:

The power loom industry has grown up from handloom sector traditionally with inherent technical knowhow passed on from forefather and is being continued in many of the clusters. The 19.44 lakh looms in the decentralized powerloom sector are spread over 4.3 lakh units with an average holding of a little over 4 looms per unit. Thus, the sector largely comprises of very tiny units with a majority of loom holdings in the range of 1 to 8. Decentralized powerloom sector is consistently meeting out the need of the fabric required for garment sector for export as well as the domestic market. The share of the decentralized sector is 62% of the total fabric production in the country.

The Handloom industry mainly exports fabrics, bed linen, table linen, toilet and kitchen linen, towels, curtains, cushions and pads, tapestries and upholstery's, carpets and floor coverings, etc. The Handloom industry has adopted various measures and techniques to provide high quality and eco-friendly products to the world market.

In the world of handlooms, there are Madras checks from Tamil Nadu, Ikats from Andhra and Orissa, Tie and Dye from Gujarat and Rajasthan; Brocades from Banaras and Kanchipuram, Jacquards from Uttar Pradesh, Daccai from West Bengal, and Phulkari from Punjab.

The Surat"Tanchoi", based on a technique of satin weaving with the extra weft floats that are absorbed in the fabric itself has been reproduced in Varanasi. Besides its own traditional weaves, there is hardly any style of weaving that Varanasi cannot reproduce. The Baluchar technique of plain woven fabric brocaded with untwisted silk thread, which began in Murshidabad district of West Bengal, has taken root in Varanasi. Their craftsmen have also borrowed the jamdani technique.

In the department of Woollen textiles, Woollen weaves are no less subtle. The Kashmiri weaver is known the world over for his Pashmina and Shahtoosh shawls. The shawls are unbelievably light and warm.

The states of Kashmir and Karnataka are known for their mulberry silk. India is the only country in the world producing all four commercially known silks - mulberry, tasser (tussore), eri and muga, now gaining immense popularity in the U.S.A. and Europe. Assam is the home of eri and muga silk. Muga is durable and its natural tones of golden yellow and rare sheen become more lustrous with every wash. The ikat technique in India is commonly known as patola in Gujarat, bandha in Orissa, pagdubandhu, buddavasi and chitki in Andhra Pradesh.

11.4 BASIC STRUCTURE OF INDIA'S TEXTILE INDUSTRY

Textile industry in India comprises of mostly of small-scale, non-integrated spinning, weaving, finishing, and apparel-making units.

- **Integrated Composite Mills:**

  Composite Mills are relatively large-scale industry and are sometime called vertically integrated Mills and will have most advance technology base for manufacturing the goods. In this kind of mills the process normally starts from spinning, dyeing, weaving, finishing and upto garmenting level. In India, however, these types of mills now account for about only 3 percent of output in the textile sector. About 276 composite mills are now operating in India, most owned by the public sector. The well-known examples are Arvind Mills in Ahmedabad, Bombay Dyeing in Mumbai, Raymonds, etc.

- **Spinning unit:**

  Spinning is the process of converting cotton or manmade fibre into yarn to be used for weaving and knitting.

- **Weaving and Knitting unit:**

  Weaving and knitting converts cotton, manmade, or blended yarns into woven or knitted fabrics. India's weaving and knitting sector remains highly fragmented, small-scale, and labour-intensive. This sector consists of about 3.9 million handlooms, 380,000 "powerloom" enterprises that operate about 1.7 million looms, and just 137,000 looms in the various composite mills.

- **Finishing unit:**

  Fabric finishing is actually a wet processing unit which includes dyeing, printing, washing and other cloth preparations prior to the manufacture of fabric. Overall, about 2,500 processors are operating in India, including about 2,000 independent units and 220 units that are integrated with spinning, weaving, or knitting units.

- **Apparel Manufacturing unit:**

  Apparel clothing is produced by about 75,000 small-scale units classified as domestic manufacturers, manufacturer exporters, and fabricators.

Summary:

Indian textile industry is just next to agriculture in terms of employment generation and size of the industry. In this chapter the student is given an overview of the Textile Industry in India. The Indian Textile industry is divided into various segments depending on its raw material production capacity. It is also divided in to Handloom and Power loom sector depending on the type of fabric being produced and its requirement. This industry is further divided based upon the end product that it supplies. The student in this chapter is made aware of these various sectors and segments of the textile industry.

Chapter- 12: Identification of Fabrics with Commercial Names

The fabric is made using various material and techniques. They are produced with different construction depending on the end usage of the fabric. They are identified by different names depending on methods by which they are manufactured, the place where they are actually made / invented or by their fibre components. This chapter is like a glossary of various fabrics that are commercially available. It will visually help the student in identification of the fabric by market name. It will also enumerate its end use.

Batik Fabric

A fabric design technique of resist dyeing or printing in which desired areas are covered, painted or printed with the mix of bee wax and paraffin wax which acts like resist and then dyed. The wax help in resisting the dyes penetration, however in the process wax cracks through which some dyes solution gets penetrated and the interesting cracks effects are produced which is quite unique. (See image 64)

Bedford Cord

It is a corded cotton-like fabric with raised ridges in the lengthwise direction. Since the fabric has a high strength and a high durability, it is often used for upholstery, trousers and work clothes

Boucle Fabric

It is a woven fabric with small curls or loops that create a nubby surface. The fabric has a looped, knotted surface and is often used in sweater looks, vests and coats. (See image 68)

Broadcloth

It is a plain weave tightly woven fabric that is usually made from 100% cotton or a cotton blend. It is used as dress materials.

Brocaded Fabric

A heavy jacquard fabric with an all-over raised pattern or floral design. Appropriate for saris, upholstery, draperies, handbags and eveningwear. Banarasi brocaded saris in India are very famous. (See image 56)

Calico Fabric

It is a tightly-woven cotton type fabric with an all-over print, usually a small floral pattern on a

contrasting background color. Common end use includes dresses, aprons, and quilts. (See Image 55)

Cambric Fabric

Cambric is a fine thin white linen fabric, woven using plain weave

Canvas Fabric

Canvas is a strong, durable, closely plain weave woven cotton fabric.

Chambray

Chambray is a plain woven fabric that can be made from cotton, silk, or manufactured fibers, but is most commonly cotton. It incorporates a colored warp (often blue) and white filling yarns. (See image 62)

Chiffon Fabric

Lightweight, extremely sheer and airy fabric, containing highly twisted fibers. It is Suitable for full pants, loose tops or dresses

Corduroy

It is a fabric, usually made of cotton or a cotton blend, utilizing a cut-pile weave construction. The "wale" indicates the number of cords in one inch. Suitable for jackets, pants and skirts. (See image 70)

Cotton Fabric

Cotton is a white vegetable fibre grown in warmer climates in many parts of the world. Cotton has been used to produce many types of fabric for hundreds of years. Cotton fabric feels good against the skin regardless of the temperature or the humidity and is therefore in great demand by the consumer. May be made into solid plain colour, strip or check cotton fabrics (See image 52, 72 & 73)

Crepe

It is used to describe all kinds of fabrics--wool, cotton, silk, rayon, synthetics and blends-that have a crinkle, crimped or grained surface.

Damask Fabric

A glossy jacquard-type fabric, the patterns are flat and reversible. Unlike jacquards, the fabric is all one color. It is suitable for draperies, curtains, bed and table linens.

Denim

It is a twill weave cotton fabric made from different coloured yarns (usually indigo) in the warp and white weft. Due to the twill construction, one colour predominates on the fabric surface. It is

suitable for trousers, jackets and skirts. The denims are usually prewashed for different effects. (See image 34)

Dobby Fabric

A Fabric made with an additional attachment to a loom wherein a decorative weave, characterized by small figures, usually geometric, that are woven into the fabric structure. (See image 48)

Double Cloth and Multi Layered Fabric

A fabric construction, in which two layered are woven on the loom at the same time, one on top of the other. In the weaving process, the two or more layers of woven fabric are held together using binder threads. The woven patterns in each layer of fabric can be similar or completely different. (See image 42 & 43, Panipat Double cloth see image 73)

Drill

Drill is Strong, medium- to heavyweight, warp-faced, twill-weave fabric. It is usually a 2/1 left-handed twill and piece dyed.

(See image 51)

Dupion Silk

It is a crisp fabric made from silk yarn which is reeled from waste cocoons. More than one cocoon is reeled together and hence a yarn with slubs on the surface is produced which is quite irregular. (See image 53)

Extra Warp and Extra Weft Design Fabric

Fabric woven on mainly plain ground with an additional yarns used in warp or weft direction to make large designs. Used in dress materials and saris. (See image 48 & 49)

Felted Fabric

It is a natural property of wool fibres. In presence of moisture, pressure and heat the scale of the wool fibres bond each other. It is a non-woven fabric made from wool, hair, or fur, and sometimes in combination with certain manufactured fibers, where the fibers are locked together. (See image 60)

Flannel

It is usually a 100% cotton fabric that has been brushed on one or both sides for softness. Typically used in baby cloth, shirts and sleepwear. (See image 69)

Fur Fabric

An artificial fur fabric made in the weaving or knitting having looks of a bird's fur or an animal hairy skin. (See image 61)

Gabardine

It is a worsted twill weave that is wrinkle resistant. Wool gabardine is the most common and is considered all season fabric for suits.

Gauze Fabric

A sheer, open-weave fabric usually cotton or silk. It is suitable for blouses, dresses and curtains. (See image 35)

Georgette Fabric

A drape able woven fabric created from highly twisted yarns creating a pebbly texture. It is semi-sheer and suitable for blouses, full pants and flowing dresses.

Gingham

It is a medium weight with a plain weave in plaid or check pattern. End use includes dresses, shirts, and curtains. (See image 65)

Herringbone

A variation of the twill weaves construction in which the twill is reversed, or broken, at regular intervals, producing a zigzag effect with clear cut line at the reversal point. (See image 26)

Honeycomb

It is one of the weaves wherein a structure just like the one created by honey bees are constructed. The fabric woven by this weave is used for towelling as it absorbs moistures. (See image 25)

Hound's Tooth Check Fabric

A fabric woven in 2:2 ratios of warp and weft using colour and weave effects. Mainly used for ladies jacketing, long coat and man' wear. (See image-24)

Ikat Fabric

It is a fabric, usually hand woven which has been tie-dyed in the yarns, prior to weaving. The pattern can range from simple little dots to single ikat (warp yarn is tie-dyed) to intricate double Ikat (where both the warp and weft yarn is tie-dyed). (See image 33)

Jacquard Fabric

Woven fabrics made using the Jacquard attachment on the loom. This attachment provides versatility in designs and permits individual control of each of the warp yarns. Thus, fabrics of almost any type or complexity can be made. Examples are Brocade and Damask fabrics. (See image 54, 56, 57 & Panipat Jacquard Double cloth see image 73)

Leno Fabrics

It is a fabric having net like structure. The warp yarns are inter-crossed with the weft, during the weaving process. It is made in various materials and can be used in the dresses. Mosquito nets are made by this weave (See image 59)

Madras Check Fabrics

It is lightweight plain or simple twill weave cotton fabric with a striped, plaid, or checked pattern. True madras checks bleeds when washed. This type of fabric is usually exported from India and once had in great demand and was used as lungis. Nowadays, Madras checks are made with good quality cotton is used in men's and women's shirts and dresses. (See image 67)

Moss Crepe

A satin based crepe fabric, light weight and very smooth, having good draping quality used for dress materials. (See image 41)

Muslin Fabric

An inexpensive, medium weight, plain weave, low count (less than 160 threads per square inch) cotton sheeting fabric. In its unfinished form, it is commonly used in fashion design to make trial garments for preliminary fit. (See image 45)

Net Fabric

It refers to any open-construction fabric which it is usually created by weaving, knitting, knotting method. (See image 31)

Organdie Fabric

A stiffened, sheer, lightweight plain weave fabric, usually cotton or polyester. (See image 40)

Organza Fabric

A crisp, sheer, lightweight plain weave fabric, with a medium to high yarn count, made of silk, rayon, nylon, or polyester. (See image 32)

Oxford Fabric

A fine, soft, lightweight woven cotton or blended with manufactured fibers in a 2 x 1 basket weave variation of the plain weave construction. The fabric is used primarily in shirting.

Pile Fabric

A fabric woven with the formation projecting surface with yarns either in the Loop form and cut form is known as pile fabric. They are produced both manually and by machine. Velvet and Terry towel are the best example of cut pile fabric. (See image 29)

Piqué Fabric

It is a medium-weight cotton or cotton blend fabric with a pebbly weave that looks almost like a check. Pique is suitable for vests, jackets and fitted blouses. It is also used in children's clothes.

Poplin Fabric

A fabric made using a rib variation of the plain weave. The construction is characterized by having a slight ridge effect in one direction. Poplin is usually associated with casual clothing.

Quilting

A fabric construction in which a layer of down or fibre fill is placed between two layers of fabric, and then held in place by stitching by hand or by machine or sealing in a regular, consistent, all-over pattern on the goods. (See image 47)

Sateen Fabric

The fabric has a soft, smooth hand and a gentle, subtle luster; it is a weft dominant structure. Sateen fabrics are often used for draperies and upholstery. (See image 46)

Satin Fabric

With a lustrous, shiny surface, drape ability depends on fiber content. Silk and rayon satins have the best stitch results. It is a warp predominant structure. (See image 36 & 37)

Seersucker Fabric

It is a fabric with a woven pucker. This fabric is traditionally cotton, but can be polyester. Suitable for shirts, casual slacks and children's clothing. (See image 28 & 44)

Scottish Check

A fabric traditionally woven in wool but now made in cotton as well as in other materials too. The design is largely check fabric having red, white and black combination with similar patterns in warp and weft direction, hence producing very balanced check fabrics. (See image 66)

Tapestry Fabric

It is a heavy, often hand-woven, ribbed fabric, featuring an elaborate design depicting a historical or current pictorial display. It is a weft dominant structure with warp that is visible on the back. End use includes wall hangings and upholstery. (See image 58)

Tarpaulin

A waterproofed canvas sometimes made of nylon or other manmade fiber.

Terry Cloth

Unclipped, looped pile, 100% cotton terry cloth is highly absorbent. French Terry has a looped reverse and a knit-like face. (See image 29)

Tissue Fabric

Light weight, sheer plain woven fabric made by using silk, fine cotton and Lurex yarns. It is used for curtains and dress material. (See image 38 & 39)

Tweed

It is a medium to heavy weight, fluffy, woollen, twill weave fabric containing coloured slubbed yarns. Common end use includes coats and suits. (See image 50)

Twill Fabric

It is a fabric that shows distinct diagonal lines on the face (e.g., tweed, denim, gabardine). (See image 50 & 51)

Velvet

With a longer pile, velvet is the most luxurious fabric. Stretch velvet has some Lycra, It can be machine washed and will not create a shine in the seat or elbows. Appropriate for tops, skirts and fuller pants.

Velveteen

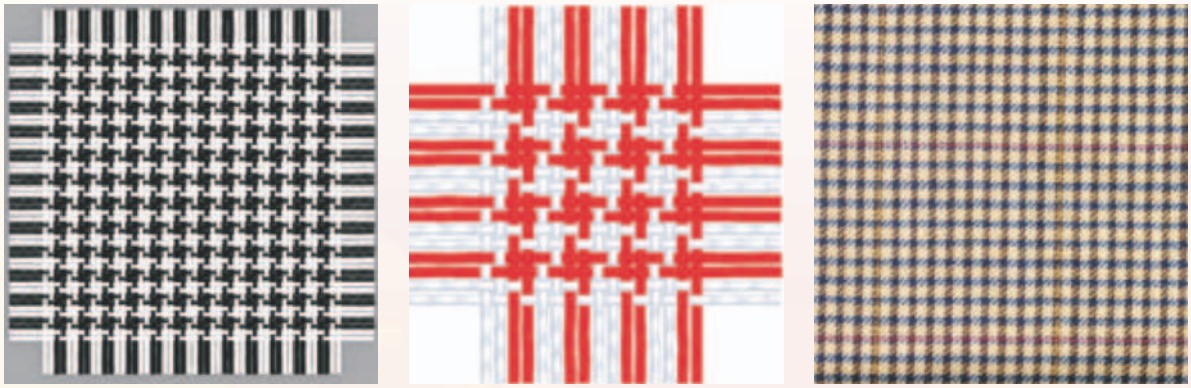
A cotton or cotton blended fabric with a short, dense pile. It lacks the sheen and drape of velvet. It is perfect for drapes and home décor items as well as trousers, jackets and skirts.

Voile Fabric

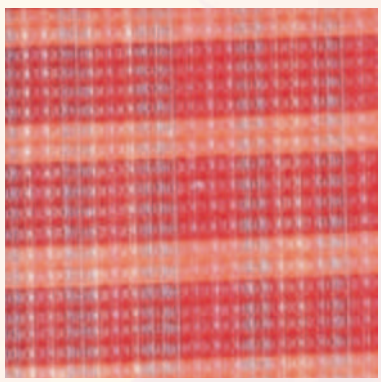
A crisp, lightweight, plain weave cotton-like fabric, it is appropriate for blouses and dresses. (See image 27)

Warp Rib:

Derivatives of plain weave structure wherein the rib formation is in the weft direction. Depending upon its weight and construction it is used for home fashion and apparel. (See image 30)



Hound's tooth effect fabric, mainly used for jacketing, blazers and long coat fabric
Image 24

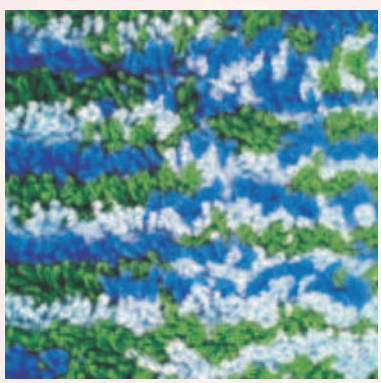


Honeycomb woven fabric structure
Image 25

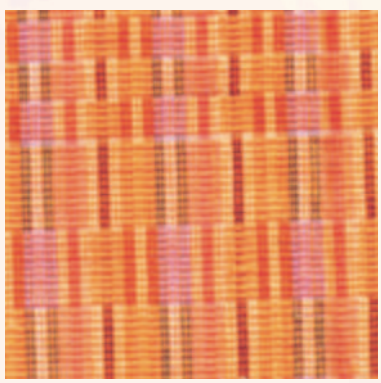
Herring bone woven fabric- a derivatives of twill woven structure
Image 26

Solid piece dyed Plain woven cotton voile fabrics
Image 27

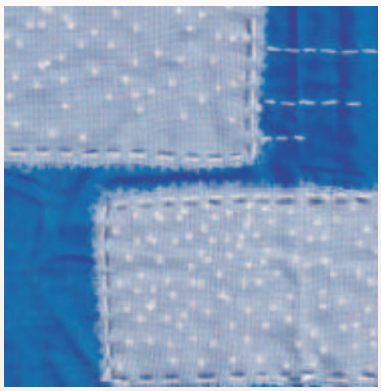
Seersucker Plain weave cotton fabrics
Image 28



Cut Pile woven fabric
Image 29

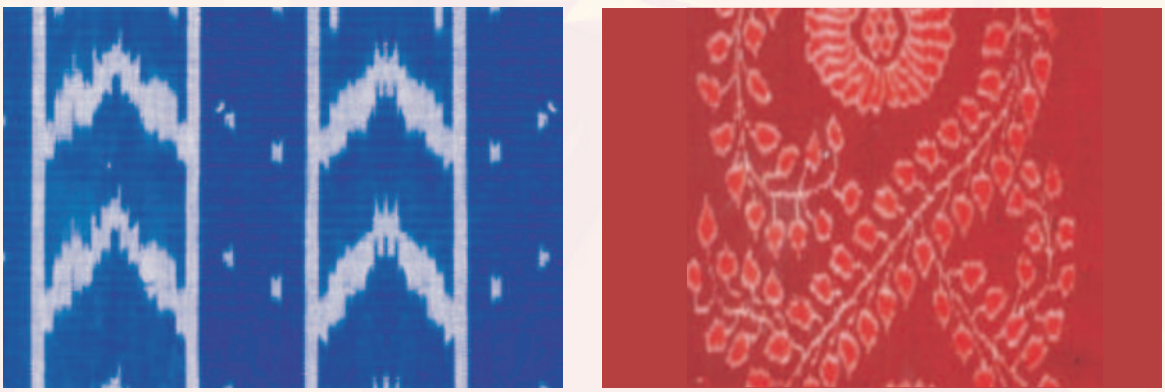


Warp rib, rib formation is in the weft direction
Image 30



Net fabric used over a fabric for ornamentation
Image 31

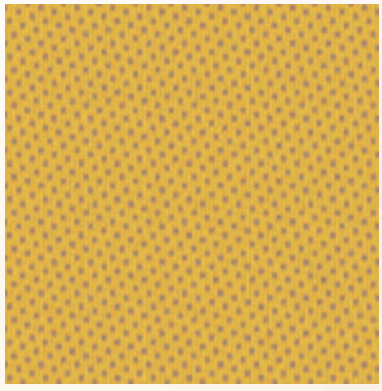
Organza fabric used along with other fabric for ornamentation
Image 32



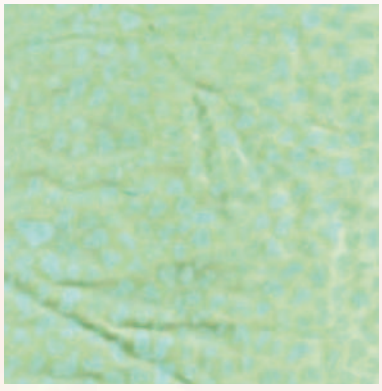
Ikat fabrics: at the top single ikat made at Hyderabad wherein only warp or weft is tie- dyed and in the bottom double ikat produced at Sambhalpur (Odisha) wherein both warp and weft is tie-dyed
Image 33

Denim usually having 3/1 twill woven with warp dyed in indigo colour and the weft is off white, now available in various shades of colour. Above the denim is printed with rubber printing technique
Image 34

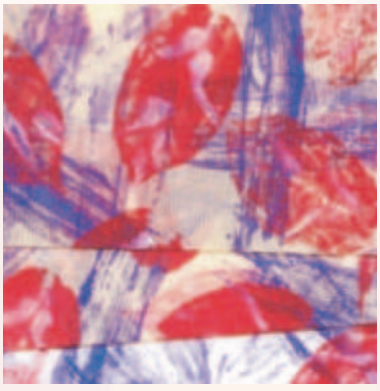
Gauze fabric in yarn dyed Cotton
Image 35



Satin (warp faced sateen) fabric structure
Image 36

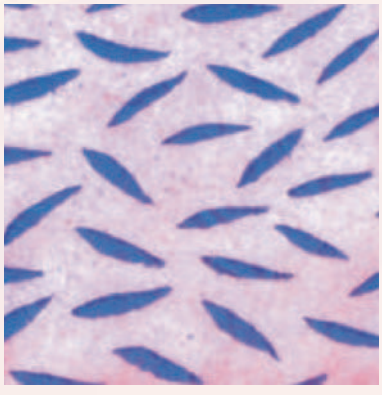


Printed Satin (warp faced sateen) fabric
Image 37



Printed tissue
Image 38

Plain Lurex tissue
Image 39

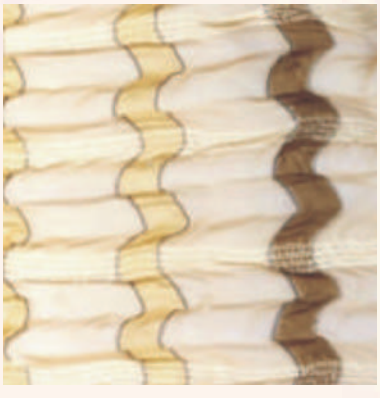


Printed organdy
Image 40

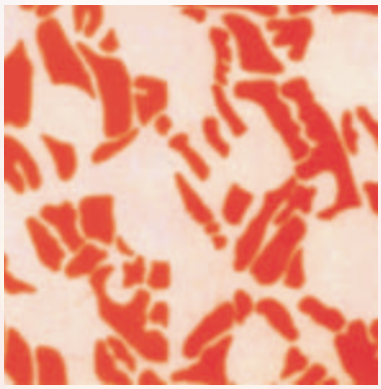
Digital printed moss crepe
Image 41

Double Cloth Fabric
Image 42

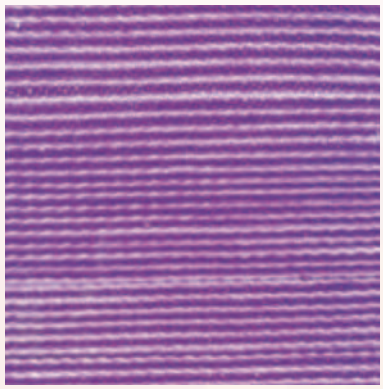
Multi layered (3 layered) fabric
Image 43



Seersucker Organza
Image 44



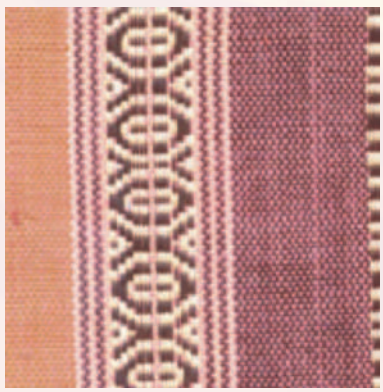
Printed Muslin fabric
Image 45



Sateen or weft satin
Image 46

Machine quilted fabric
Image 47

Extra weft design on a fabric
Image 48



Extra warp design made using dobby on a fabric
Image 49

Tweed a Twill weave on a trouser fabric
Image 50

Drill- A twill weave used as trouser or Jacketing fabric
Image 51

Cotton check fabric
Image 52

Dupion silk fabric
Image 53

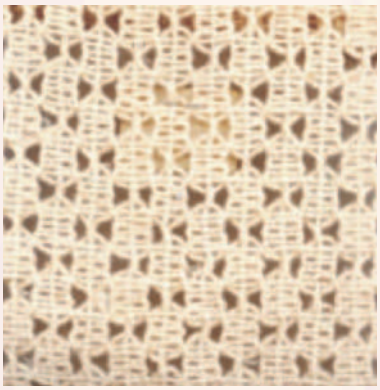
Jacquard woven fabric
Image 54

Calico fabric
Image 55

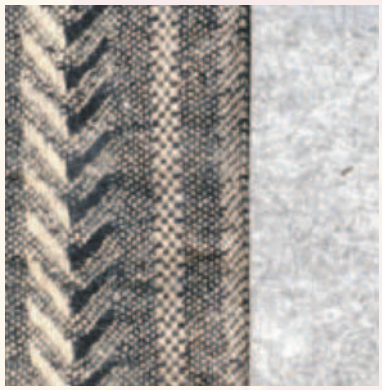
Jacquard woven brocade fabric
Image 56

Aamir Khan: Electronic
Jacquard woven fabric
Image 57

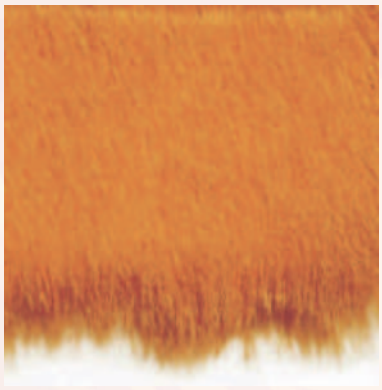
Simple Tapestry weave
Image 58



Leno weave
Image 59



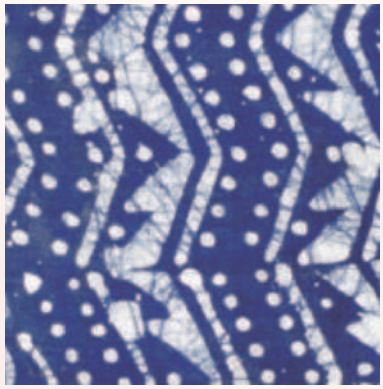
Felted woolen fabric
Image 60



Artificial Furfabric
Image 61

Chambray fabric
Image 62

Dobby fabrics with Small buties made on it
Image 63



Batik printed fabric
Image 64

Gingham check fabrics
Image 65

Scottish check fabric
Image 66

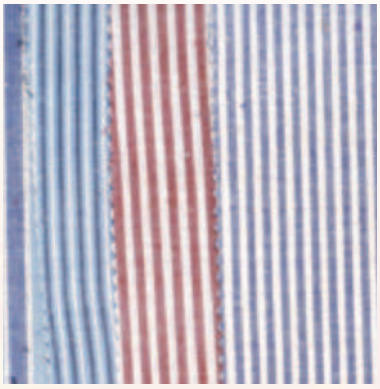
Madras check fabrics
Image 67

Boucle fabric
Image 68

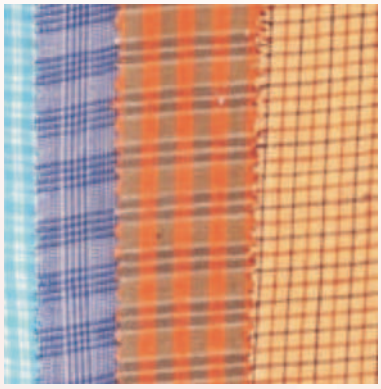
Flannel Fabric
Image 69

Corduroy fabric used for trousers
Image 70

Panipat Double cloth made on Jacquard
Image 71



Cotton stripe fabric
Image 72



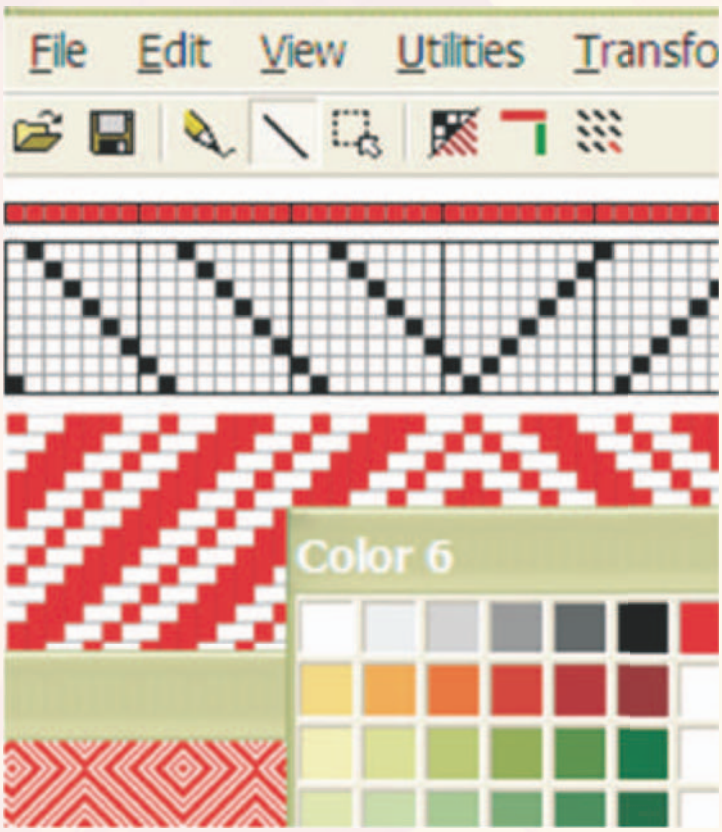
Cotton Checkfabric
Image 73

Chapter- 13:
Computerization in Textile Design

13.1 INTRODUCTION

In recent past computers have played an important role in developing the designs extensively. Computers and electronics devices are important in developing design using sophisticated **CAD (Computer Aided Design)**. Microcomputers control the operations of individual thread to create the design. Quick Style Change (QSC) and electronic jacquard allow changes from one fabric style to another in a few minutes, as compared with the several hours of hard work. With QSC shorter minimum yardage order is possible. There are several agencies in the world selling customized CAD software meeting the needs in wider range.

Application of Computer technology in weaving has made tremendous advances. Automation helps reduce fabric defects and made the delivery of the fabric faster. Weaving quality and efficiency have improved as some mills started using automatic looms with multifunctional microcomputers. The computer alters loom operation so that high speed of filling insertion are maintained while adjusting for minor changes in tension of both warp and filling yarns and winding up woven fabric. Computer detects incorrect filling insertions, removes the incorrect insertion, correct the problem, and restart the weaving operation.



13.2 ADVANCEMENTS IN LOOM TECHNOLOGY

Over the years several Research and Development (R&D) have been carried out in sophisticated and advanced weaving technologies. Hence this has placed weaving industry in dealing with the customer demand more effectively. The advancements have centred mainly on:

1. Devices to weave the more complex and intricate designs
2. Advanced computer application and electronic monitoring system to increase the speed, efficiency of the machine. This in turn has improved the quality of the fabric.
3. Faster and more efficient means of inserting filling yarns
4. Automation of devices to speed the take-up of woven fabric and let-off motions.
5. Devices that facilitate and speed up changing the warp.

Summary:

Computers have played an important role in developing the designs easily. It reduces the production cost. The visual appearance of the fabric can be seen by stimulating it on the Computer. Computers and electronics devices are important in developing design using sophisticated CAD. This chapter very briefly informs the students about the computerization in the textile industry and new advancements. More research and advancements are still happening in this sector.

Unit - 4 Assignment

1. Assignment:

Visit a fabric production unit nearby your house or school, collect yarns, fabric samples, photograph of various looms and make a visual presentation in your learning diary. Alternatively a visit to a fabric production unit can be arranged by school and then students may be asked to complete the above task.

2. Answer the following questions

Q.1. What are the various end uses of the fabrics, name any 10 of it?

Q.2. Name the various segments of the Indian textile industries?

Q.3. Name the kind of shawls produced by the Kashmiri weavers?

Q.4. Name the basic structure of the Indian textile industries?

Q.5. Name the type silk produced in Assam?

3. Fill up the blank.

1. The Surat……is based on a technique of satin weaving.
2. The ……technique of plain woven fabric is brocaded with untwisted silk thread.
3. ……is a strong, durable, closely plain woven cotton fabric.
4. ……..a fabric, usually made of cotton or a cotton blend, utilizing a cut-pile weave construction.
5. ……..is Strong, medium- to heavyweight, warp-faced, twill-weave fabric.

4. Choose the correct answer from the given options.

1. CAD is

a) Computer aided design

b) Computer aided disk

c) Computer aided drawing

d) None of the above

2. Velvet and terry are

a) Very hard kind of fabrics

b) Loop or cut form of pile fabrics

c) Weft dominant fabrics

d) Fabric produces diagonal lines

3. Hound's tooth effect is produced

a) by 2:2 ratio warp series

b) by 2:1 ratio warp series

c) by 1:2 ratio warp series

d) None of the above

4. Organdy is a fabric

a) With high twisted yarn

b) Having light with and stiffened

c) Having derivatives of plain weave

d) Balanced twill

5. A fabric with pucker

a) Seer sucker

b) organza

c) Pique'

d) None of the above

Glossary

Animal Fibre: They are produced by animals or insects and are protein in composition, E.g.: Silk fibre and Wool fibre

Basket/Matt or Hopsack weaves: One of the derivatives of plain weave having the interlacements just like in the mats.

Beating-up: The carrying forward of the last inserted pick or weft, to the fell of the cloth.

Bonding (Non-Woven / Felting): Bonding together of entangled fiber or filament or yarn, mechanically, thermally or chemically to form a sheet or web structure. Example: Lining in automobiles

Cloth: May be used synonymously with fabric but often refers to a finished piece of fabric used for a specific purpose.

Creel: During warping Yarn packages are placed on a large metallic frame known as creel.

Dent: The gap between the two metallic or wooden strip of the reed is known as dent.

Denting order: Passage warp through the reed in an appropriate order is called denting order.

Drafting order: Passage warp through the Heald shaft in an appropriate order is called drafting order.

Ends per inch: This is defined as the number of ends or warp threads in one inch of the fabric.

Fabric Density: The fabric density is defined as the number of ends and picks in a unit of a fabric. It is measured as ends per inch and picks per inch

Fabric: Refers to any material made through weaving, knitting, spreading, crocheting, or bonding that may be used in production of further goods (garments, etc.).

Fibres: Are delicate, hair portions of the tissues of a plant or animal or other substance that are very small in diameter in relation to their length.

Interlacing - Weaving: Interlacing of lengthwise yarn (warp) with the width wise yarn (weft/ filling) which are perpendicular to one another. Example: Shirting

Interloping - Knitting: Interloping of one yarn system into vertical columns and horizontal rows of loops called wales and courses respectively with fabric coming out of the machine in the wales direction. Example: Sweaters, hosiery

Loom: The fabric is usually woven on a loom, a device that holds the ends or warp (vertical Yarns) in place while picks or filling yarns(horizontal yarns) are woven through them.

Manmade Cellulosic Fibre: The natural material of cellulose can be taken from cotton linters and wood pulp, processed chemically and changed in form and other characteristic to form manmade cellulosic fibre. E.g.: Rayon, Modal

Manmade Fibre: These are derived from various sources.

Metallic Fibers: They are composed of metal, plastic coated metal, metal-coated plastic or a core completely covered by metal. They are used as decorative yarn for various apparel and home furnishings.

Mineral Fibre: These are mined from certain types of rocks, E.g.: Asbestos fibre

Minerals Fibers: Various minerals have been manufactured into glass, ceramic and graphite fibres having prescribed properties for specific use. E.g.: Glass fibers

Natural Fibre: These fibres include those produced by plants, animals and geological processes. They are biodegradable over time. They can be classified according to their origin.

Non-cellulosic Polymer Fibres: They are synthesized or created from various elements into large molecules which are called linear polymers because they are connected in link-like fashion. E.g.: Acrylic fibre, Nylon fibre, Polyester fibre

Picking: The insertion of the weft thread, which traverses across the fabric, through the shed.

Picks per inch: This is defined as the number of picks or weft threads in one inch of the fabric.

Plain weave: The most prominent and common class of weave

Reed Count: The Reed Count is defined as number of dents in two inches.

Reed: It is a metallic comb like structure in a loom which is made up of number of metallic or wooden wires.

Sateen & Satin: A sateen weave is predominantly a weft faced weave, whereas satin is a warp dominant fabric

Selvedge: Extreme ends of the both the sides of a fabric in width wise, having warp ends per dent or per inch more than the body area in the fabric. The selvedge of the fabric is the self-finished edges of the fabric.

Shuttle: Is a device that contains a bobbin on which filling yarn is wound.

Sizing: The sizing paste is applied on the warp yarn with the warp sizing machine, it gives

sufficient strength to the yarn so as to minimise frequents breakages of yarns during the process of weaving.

Technical Textiles: Textiles used for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as Technical Textiles

Textile: Refers to any material made of interlacing fibres.

Tufting: It is"Sewing" a surface yarn system of loops through a primary backing fabric into vertical columns (rows) and horizontal lines (stitches) forming cut and/or uncut loops (piles) with the fabric coming out of the machine in the rows direction. Fabric must be back-coated in a later process to secure tufted loops.

Twill weave: Twill weaves can easily be identified by its general characteristic with its series of more or less pronounced diagonal lines in either warp or weft direction.

Vegetable Fibre: It is found in the cell wall of plants and are cellulosic in composition. E.g., cotton fibre, jute fibre.

Warp or ends: Vertical series on a loom is termed as warp or yarn parallel to selvedge is called warp or ends.

Warp Rib: one of the derivatives of plain weave having rib formation in weft wise.

Warping: The process of converting yarn from single end package to an even sheet of yarn representing hundreds of ends (multiple end packages) is called Warping.

Weave: The way the warp and filling threads interlace with each other is called the Weave.

Weft of picks: All Horizontal series in a fabric is termed as weft or picks.

Weft rib: one of the derivatives of plain weave, having rib formation in warp wise.

Yarn: The strands of fibres are twisted or spun together to form a Yarn that is made into a Fabric.

CREDITS

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Mr. Asif Ahmed, Textile Design Department at NIFT Gandhinagar, batch 2010-14

Book layout:

Ms. Shubhangi Yadav & Ms. Rupali Pandit, Associate Professor, Textile Design Department at NIFT Gandhi Nagar

Computer Illustrations in Unit III and Unit -IV:

- Mr. G. Rajesh Kumar, Assistant Professor NIFT Hyderabad

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Mr. Asif Ahmed, of Textile Design department at NIFT Gandhinagar, batch 2010-14.

Woven Textiles

Practical Manual

Contents

UNIT - 1

The student should make a scrap book (i.e. a 200 Pages Plain Paper Book). The Assignments 1, 2, should be done in this notebook.

Assignment No. 1

The basic raw material used by the textile industry for making a fabric is Fiber . Many different kinds of fibers are used for making a Yarn. The strands of fibers are twisted or spun together to form a Yarn that is made into a Fabric.

The characteristic of the fabric changes depending in the fiber used for making a fabric. The fabrics made from different fibers have different feel, look, comfort, texture, physical and chemical properties.

Objective: To understand the different materials (Fiber Types) used to make a fabric and study its characteristics

Method:

1. The student should go to a cloth shop, tailor or mall in the neighborhood and collect the following swatches.
2. Cut these swatches into 5"x 5" pieces and stick them in the scrap books
3. The swatches to be collected are:

a. Silk	b. Cotton	c. Jute
d. Polyester	e. Wool	f. Linen
g. Non-woven Fabric	h. Viscose	i. Acrylic
j. Modal		

4. Classify these swatches and write about their look (Dull, Bright, rough, etc.), texture (rough, smooth, etc.) and find out 1 to 2 physical and chemical properties.

Outcome: The students will understand the different quality of fabrics and will be able to identify them.

Assignment No. 2

Weaving is done on a machine called loom. There are many types of looms as studied in chapter 3 of Unit I. The loom is classified on the basis of method of insertion of weft.

Objective: To study and understand the different types of looms.

Method:

1. Group of 5-6 students should take up one type of loom (Ex, Handloom, Rapier, Airjet, etc.)
2. Each group should then study and discuss the loom type in detail to understand its
   a. Brief History
   b. Working and Technology
   c. Usage and Application
   d. Advantages
   e. Disadvantages
   f. And any other point (if there)
3. The Group should then make a 10-15 slide power point presentation and present to the whole class

Outcome: All the students will understand the different types of looms available for fabric manufacturing.

UNIT - 2

Assignment No. 3

Arrange a class visit of the students to a composite textile mill (i.e. a textile mill that has process from spinning to weaving to fabric processing)

Objective: To understand working of a textile unit as studied in the textbook

Method:

1. After the visit the student should make a detailed flowchart to show process flow from Weaving Preparatory (i.e winding) to weaving in their scrap book.
2. The students should write a small note on why each of the process is required
3. The students should write the names of the input and output package at each process.

Outcome: The student will understand in detail the working of the textile mill

Assignment No. 4

Woven Fabrics are made up of vertical (Length wise) yarns called Warp and horizontal (width wise) yarns called Weft. These threads are interlaced with one another in many different ways and each class of structure forms the Design.

Paper Weaving will help students to understand how the interlacement of colored paper or newspaper can produce interesting textures. The teacher should make the student interlace the paper stripes in different ways without the constraint of weaves and ask them to study the different effects produced.

Aim: To gain knowledge and visualize the effect of interlacing of material

Method:

1. Take any colour paper/newspaper with or without image
2. Cut them in vertical and horizontal Stripes of same and different sizes
3. Create interesting woven textures by using these as warp and weft by interlacing them in different order.
4. Make at least 5-6 structures and stick them in the scrap book

5. (Demonstration of the same by the faculty is needed)

Outcome: The students will understand the difference between a Flat Paper and then when it is cut in to stripes and woven, the textures that it generates. This will help the student to understand the interaction between the different types of yarns counts and colors when they are woven together.

Practical Assignment

Lab requirements for a batch of 30 students

- Lab Size: 2000 SFT
- No. **Table top** sample **Looms:** 30 (24 inch width) complete with accessories like shuttles, lease rods, heald shafts with proper lifting mechanism)
- No. of **Warping Mill:** 10 (horizontal type or vertical type or peg warping frames)
- No. of Hand driven **charkha:** 10
- 4-6 inch Empty **Bobbins** (made in plastic): 500
- **Metallic Reeds:** 8s, 10, 16s, 20s, 24s, 282, 302, 32s, 36s, 40s, 42s etc: at least 10 in each counts each measuring 24 inch
- **Reed Hooks:** required 30 but may be procured in double the quantity for better stock.
- **Shuttles:** 60 (hand throw shuttles)
- **Pair of scissors**
- Cutter
- Rulers
- Sufficient quantities of **Yarns in hank form, cone form** or in both forms, yarns in various counts and colours such as 4s, 6s, 10s, 20s, 30s. 32s. 40s, AND 2/4s, 2/6s, 2/10s, 2/20s, 2/17s,2/30s. 2/32s. 2/40s,

Assignment No. 5

The loom has to be made ready before weaving. For the same the students need to understand the total ends required for weaving a swatch, EPI, count and the colors of the yarns to be used.

Aim: Set up the loom to be used for weaving in the next assignments

Materials for warp:

- This Material requirement is for Practical 1, 2 and 3 combined
- A combined warp of 4 meter length for the entire weaving is to be set up. (Warp could be cotton in any one of the count, 2/10s or 2/17s or 2/20s)

Method:

1. **The student should select the yarns for weaving (i.e which count and colour)**
2. **Calculate the Warp Requirement for setting up the loom**
   a. Take Reed as per the count of the yarn selected
   b. Calculate the warp requirement i.e. the Total Ends
3. The student should learn to warp the yarn on the creel (make lease, count the crosses, etc)
4. The students should then be taught to do Drafting (4 shafts Straight Draft)
5. Do Denting (4 Ends/Dent for Selvedge and 2 Ends/Dent for Body)
6. Setting up the loom i.e warping and winding the warp on the weaver's beam

Outcome: The student will learn to set up the loom which will then be used for weaving the upcoming practical assignments.

Practical Assignment

(Practical has been divided into two parts: Part A deals with the practical fabric sample weaving on the table top loom while Part B deals with graphical representation of different weaves)

Part A

Aim: To use inch graph paper (The square grid paper used to draw design, draft and peg plan) to practice the following weaves

Material required: Inch graph paper, Pen, Sketch pens, HB Pencil, Eraser, pencil sharpener, scale, and note pad.

Assignment No. 6

Use graph paper to draw plain weave with drafting and peg plan.

Assignment No. 7

1. Draw 5 regular or irregular Mat weaves with drafting and peg plan
2. Draw 5 regular or irregular Warp Ribs with drafting and peg plan
3. Draw 5 regular or irregular Weft Ribs with drafting and peg plan

Assignment No. 8

1. Draw 5 Balanced Twill weave with drafting and peg plan
2. Draw 5 Un balanced Twill weave with drafting and peg plan
3. Draw 5 "S" Twill with drafting and peg plan
4. Draw 5 "Z" Twill with drafting and peg plan

Assignment No. 9

1. Draw 5 regular and irregular sateen weave with drafting and peg plan
2. Draw 5 regular and irregular satin weave with drafting and peg plan

Outcome: The student will be able to draw design, draft peg plan for all the designs that they have studied.

Part B

Fabric Weaving:

Fabric weaving refers to any material made through weaving. Weaving as such carried using an instrument known as the Loom. The loom may be operated by hand and is called hand loom. When the loom us operated using power it is called powerloom. The fabric thus produced using these looms may be used in production of any end use product such as garments. When a material is constructed using any textile fiber into 2 dimensional or 3 dimensional structures which may be drape-able, spreadable and pliable, is called a fabric.

Assignment No. 10: Sample weaving - Plain Weave

Name of the weave: Plain weave

Equipment: Table top loom

No. of shafts requires: 4

No. of shuttles: 1-2

Materials for warp: As mentioned on Page 2

Materials for weft: Weft could be cotton in any one of the count, 2/10s or 2/17s or 2/20s

Aim of the Practical assignment:

To construct a plain weave on a table top loom.

Principles:

In principle in order to construct a plain weave, each warp yarn passes alternatively over one and then under one weft yarn. They require only two heald shafts or harnesses because the weave repeats every two ends and two picks. When one heald shaft is raised the other is lowered, and then the sequence is reversed for the next pick

Requirements:

In order to weave it requires a loom with a warp on it, with variety weft yarn, a shuttle with technical sheet having information about the weaves and lifting plan.

Procedure/methods:

Based on the information provided in technical information the weaving is carried out

Observations:

Observe the passage of warp and the way warp yarns are lifted and the manner in which the weft yarn is inserted to achieve a plain weave.

Viva Questions:

What is the two most primary element used in a weaving?

Assignment No. 11: Sample weaving - Mat Weave

Name of the weave: Mat weaves

Equipment: Table top loom

No. of shafts requires: 4

No. of shuttles: 1-2

Materials for warp: As mentioned on Page 2

Materials for weft: Weft could be cotton in any one of the count, 2/10s or 2/17s or 2/20s

Aim of the Practical assignment:

To construct derivatives of plain weave that is Mat weave.

Principles:

In principle in order to construct a Mat weave, two warp yarn passes alternatively over two and then under two weft yarn.

Requirements:

In order to weave it requires a loom with a warp on it, with variety weft yarn, a shuttle with technical sheet having information about the weaves and lifting plan.

Procedure/methods:

Based on the information provided in technical information the weaving is carried out

Observations:

Observe the passage of warp and the way warp yarns are lifted and the manner in which the weft yarn is inserted to achieve a Mat weave.

Viva Questions:

How the Mat weave is similar to that of plain weave?

Assignment No. 12: Sample weaving - Rib Weave

Name of the weave: Warp Rib weaves or Weft Rib weaves

Equipment: Table top loom

No. of shafts requires: 4

No. of shuttles: 1-2

Materials for warp: As mentioned on Page 2

Materials for weft: Weft could be cotton in any one of the count, 2/10s or 2/17s or 2/20s

Aim of the Practical assignment:

To construct a warp/ weft Rib weave on a table top loom.

Principles:

In principle in order to construct a Rib weave, one or each set of warp yarn passes alternatively over one or set of weft yarn. They require only two heald shafts or harnesses because the weave repeats every two or more ends and two or more picks. When one heald shaft is raised the other is lowered, and then the sequence is reversed for the next pick.

Requirements:

In order to weave it requires a loom with a warp on it, with variety weft yarn, a shuttle with technical sheet having information about the weaves and lifting plan.

Procedure/methods:

Based on the information provided in technical information the weaving is carried out.

Observations:

Observe the passage of warp and the way warp yarns are lifted and the manner in which the weft yarn is inserted to achieve a Rib weave.

Viva Questions:

What is the two most primary element used in a weaving?

Assignment No. 13: Sample weaving - Twill Weave

Name of the weave: Twill weaves

Equipment: Table top loom

No. of shafts requires: 4

No. of shuttles: 1-2

Materials for warp: As mentioned on Page 2

Materials for weft: Weft could be cotton in any one of the count, 2/10s or 2/17s or 2/20s

Aim of the Practical assignment:

To construct Twill weave.

Principles:

2 up and 2 down twill (2/2) running from right to left repeating on four ends and four picks. In this weave equal size of lines are formed by alternately raising and lowering down two warp threads for every pick and stepping one warp thread in consecutive rotation as successive picks are inserted

Requirements:

In order to weave it requires a loom with a warp on it, with variety weft yarn, a shuttle with technical sheet having information about the weaves and lifting plan.

Procedure/methods:

Based on the information provided in technical information the weaving is carried out

Observations:

Observe the passage of warp and the way warp yarns are lifted and the manner in which the weft yarn is inserted to achieve a Twill weave.

Viva Questions:

How to identify a twill weave?

Assignment No. 14: Sample weaving - Sateen Weave

Name of the weave: Sateen weaves

Equipment: Table top loom

No. of shafts requires: 5 (the student will be required to redraft and re-dent for this swatch)

No. of shuttles: 1-2

Materials for warp: As mentioned on Page 2

Materials for weft: Weft could be cotton in any one of the count, 2/10s or 2/17s or 2/20s

Aim of the Practical assignment:

To construct Sateen weave.

Principles:

5 End Sateen can be woven using the move of 2 and move of 3.

Requirements:

In order to weave it requires a loom with a warp on it, with variety weft yarn, a shuttle with technical sheet having information about the weaves and lifting plan.

Procedure/methods:

Based on the information provided in technical information the weaving is carried out

Observations:

Observe the passage of warp and the way warp yarns are lifted and the manner in which the weft yarn is inserted to achieve a Sateen weave.

Viva Questions:

How to identify a sateen weave?

Assignment No. 15

Collect any 10 varieties of fabric swatches (as taught in the Chapter-12) from the nearest market or tailor shop, cut them into 5"x 5" swatch pieces and stick them in your books with its commercial name and basic qualities of fabrics.

The various fabrics are available in the market. The fabric could be a plain weave or mat or twill, but they are usually not sold in the market with these names.

The fabrics are sold in the market with commercial name. For example the fabric could be plain woven fabric but it is called as poplin, cambric, lizzy bizzy, etc. These names have been derived maybe because of its composition, the mill that first made this variety of fabric, its construction.

Objective: To study the different variety of fabric as available by the commercial name.

Method:

1. The student should go to a cloth shop, tailor or mall in the neighborhood and collect the following swatches.
2. Collect at least 10 swatches by the commercial name as taught in the chapter-11 of Unit-IV
3. Cut these swatches into 5"x 5" pieces and stick them in the scrap books
4. Classify these swatches
5. Write there
   a. EpI X PPI
   b. Weave
   c. Weight (in Grams per square meter)
   d. End Use

Outcome: the students will understand the different commercially available fabrics and will be able to identify them.