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Tailoring and Dress Designing • Apparel and Textile Design

Tailoring and Dress Designing

Apparel and Textile Design

NETAJI SUBHAS OPEN UNIVERSITY

PREFACE

In the curricular structure introduced by this University for students of Diploma programme, the opportunity to pursue Vocational course in Subjects introduced by the University is equally available to all learners. Instead of being guided by any presumption about ability level, it would perhaps stand to reason if receptivity of a learner is judged in the course of the learning process. That would be entirely in keeping with the objectives of open education which does not believe in artificial differentiation. The syllabus of this particular course has been designed in line with the NSQF.

Keeping this in view, study materials of the Diploma level in different subjects are being prepared on the basis of a well laid-out syllabus. The course structure combines the best elements in the approved syllabi of Central and State Universities in respective subjects. It has been so designed as to be upgradable with the addition of new information as well as results of fresh thinking and analysis.

The accepted methodology of distance education has been followed in the preparation of these study materials. Co-operation in every form of experienced scholars in indispensable for a work of this kind. We, therefore, owe an enormous debt of gratitude to everyone whose tireless efforts went into the writing, editing and devising of a proper lay-out of the materials. Practically speaking, their role amounts to an involvement in 'invisible teaching'. For, whoever makes use of these study materials would virtually derive the benefit of learning under their collective care without each being seen by the other.

The more a learner would seriously pursue these study materials the easier it will be for him or her to reach out to larger horizons of a subject. Care has also been taken to make the language lucid and presentation attractive so that they may be rated as quality self learning materials. If anything remains still obscure or difficult to follow, arrangements are there to come to terms with them through the counselling sessions regularly available at the network of study centres set up by the University.

Needless to add, a great deal of these efforts is still experimental—in fact, pioneering in certain areas. Naturally, there is every possibility of some lapse or deficiency here and there. However, these do admit of rectification and further improvement in due course. On the whole, therefore, these study materials are expected to evoke wider appreciation the more they receive serious attention of all concerned.

Professor (Dr.) Subha Sankar Sarkar
Vice-Chancellor

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NETAJI SUBHAS OPEN UNIVERSITY

Tailoring and Dress Designing

Paper
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PAPER
APPAREL AND TEXTILE DESIGN

Unit 1 ❑ Introduction to Textile Fibre and Yarn

Structure

1.0 Objectives

After going through this unit you shall be able to know—

- the textile fibres
- the classification of textile fibres
- the properties for end-use requirements
- the types of yarn having an important effect on the fabric

- the types, uses, and optimum applications of sewing threads
- how woven fabrics are manufactured
- various types of weaves

Learning Outcome :

After learning this lesson we know about textile fibres and its classification, identification and characteristics, different types of yearns and their application and fabric properties.

1.1 Introduction

Textile is a broad term referring to any material that can be made into fabric by any method. Textile industry encompasses the production and marketing of fibres, yarns and fabrics, including trimmings and findings. This production and marketing chain includes the following steps : fibre production, yarn production/formation, fabric production, dyeing, printing and finishing. Textile industry basically represents the first level of the fashion industry. Textile mills and converters are the producers of yarns and fabrics and the suppliers to the apparel industry.

Textile mills are the producers of yarns and fabrics. Same industry produce any yarn, whereas others manufactured knitted and woven unfinished fabric, called greige goods either from their own yarn or purchased yarns. Many composite industries produce born greige goods and finished fabrics.

1.2 Fibre Sources

Fibres are classified into those found in nature, called **natural fibres**, or those that are **manufactured** through the use of chemicals, called **Manufactured fibres or** man made fibres.

1.2.1. Natural Fibres

Natural fibres are obtained from plants or animals, plants or vegetable fibres may come from stems (e.g., flax, hemp jute ramie), leaves (e.g., sisal, abaca), or seeds (e.g., cotton, kapok) of plants

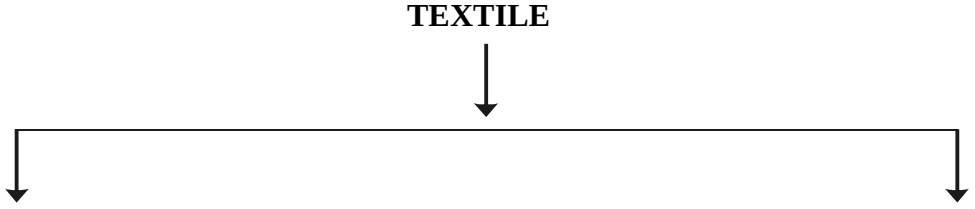
Animal fibres (e.g., wool, cashmere, mohair, and vicuana) protect people against the cold the same as they do animals. Silk is considered an animal

fibre, although it comes from the cocoon of a silkworm rather than a mammal's fur. Both silk and wool are classified as animal protein fibres.

1.2.2. Manufactured Fibres

Manufactured or man-made fibres are made from chemical solutions that are forced through tiny holes, similar to water passing through a showerhead. The device used to form the filaments is called a **spinnerette.** It looks like a thimble with tiny holes on the top or flat surface area. The fine liquid streams of solution that are forced through the holes are hardened into continuous strand called filament fibres or simply filament.

The fibre may be classified as follows—



NATURAL FIBRES

A) VEGETABLE FIBRES (Cellulose)
- o Seed fibres
  - ● Cotton
  - ● Kapok
  - ● Coconut
- o Bast fibres
  - ● Flax
  - ● Hemp
  - ● Jute
  - ● Ramila
- o Leaf fibres
  - ● Sisal
  - ● Manila

MANUFACTURED FIBRES

A) NATURAL POLYMER FIBRES
- o Cellulosic origin
  - ● Viscose
  - ● Lyocell
  - ● Modal
  - ● Cupro
  - ● Acetate
  - ● Triacetate
- o Alginate origin
  - ● Alginate
- o Rubber origin
  - ● ~~Rub~~ber

B) ANIMAL PROTEIN FIBRES

(i) Wool

- o Fine hair origin
  - ● Alpaca
  - ● Llama
  - ● Vicuna
  - ● Guanaco
  - ● Camel
  - ● Rabbit
  - ● Angora
  - ● Mohair origin
- o Coarse hairs
  - ● Cattle
  - ● Horse
  - ● Goat

(ii) Silk

- ● Cultivated
- ● Wild(e.g., Tussah)

alcohol

B) SYNTHETIC POLYMER FIBRES

- o Elastomeric origin
  - ● Elastane
  - ● Elastodiene
- o Polyacrylics origin
  - ● Acrylic
  - ● Modacrylic
- o Polyamides origin
  - ● Nylon
  - ● Aramid
- o Polyester origin
  - ● Polyester
- o Polyolefins origin
  - ● Polyethylene
  - ● Polypropylene
- o Vinylal origin
  - ● Polyvinyl

C) MINERAL FIBRES

- o Asbestos

D) INORGANIC FIBRES

- o Glass origin
  - ● Glass
- o Carbon origin
  - ● Carbon
- o Metalic origin
  - ● Metal

1.2.3. Identification of Textile Fibres

It is not possible to distinguish one fiber from another merely by touch or sight. Textile fibres must be identified using different techniques. Different tests, each of which has advantages and disadvantage, must be performed. Some are easy, quick and relatively inexpensive. But do not allow clear distinction to be made between fibres with the same characteristics.

In the absence of proper labels, the fibre type can be identified by simple tests as follows:

Microscopy: A good microscope is needed. Cotton and wool have distinctive appearances.

Burning Test: A specimen of fibres, yarns or fabric is held horizontally with tweezers. Its behavior as it approaches the flame, how it burns, the smell and the residue are all observed.

Dry Tearing Test: A piece of fabric is snipped and then torn by hand. The length of the broken fibre ends is observed.

Wet tearing Test: A drop of water is applied and the behavior of the wet piece is observed during tearing.

Solubility Test: Used mainly to identify fibre blends. The material is immersed in various chemicals for several hours. Acids are used in concentrated form.

1.2.4. End Uses of Fibres

a) **Natural Vegitable Fibres**

i) ***Cotton Fibres :*** The end uses of cotton include a wide range of products in the apparel, interior furnishing, and industrial areas. Examples blouses, pants, jackets, towel, carpets, curtains, belts, and sneakers.

ii) ***Flax Fibres :*** The principal end uses of flax include dresses suits, sports jackets, and luxury tablecloths and napkins etc.

b) Natural Animal Fibres

i) ***Silk Fibres :*** The principal end uses of silk include dresses, scarves, blouses and other apparel. Some silk is used in household furnishing, particularly decorative pillows.

ii) ***Wool Fibres :*** The principal end uses of wool include overcoats, suits, sweaters, carpets and felt fabrics.

c) Manufactured Regenerated Cellulose Fibres

i) ***Viscose Rayon Fibres :*** The end uses of viscose rayon include a wide range of products in the apparel, interior furnishings, and industrial areas. Examples include dresses, shirts, lingerie, jackets, draperies, medical products, non-woven fabrics, hygiene products.

ii) ***Acetate Fibres :*** The principal end uses of this fibre include lining fabric, lingerie, backing fabric for bonded materials and cigarette filter material.

iii) ***Lyocell Fibres :*** The end uses of this fibre include apparel, interior furnishings, and industrial products.

d) Manufactured Synthetic Fibres

i) ***Polyester Fibres :*** The end uses include a wide range of products in the apparel, interior furnishing, and industrial areas. Suits, skirts, lingerie, curtains, carpeting, sails, tire card, fiberfill, used to stuff pillows, and comforter threads are some examples of its uses.

ii) ***Nylon Fibres :*** The end uses include a wide range of products in the apparel, interior furnishing and industrial areas. Examples are lingerie, swimwear, exercise weae, hosiery jackets, bedspreads, carpets, upholstery, tents, fish nets, sleeping bags, rope, luggage.

iii) ***Acrylic Fibres :*** The principal end uses of this fibre include sweaters, blankets, carpeting, children's garments, and outdoor products, such as bunting and canopies.

iv) ***Polypropylene Fibres :*** The important apparel end uses are athletic clothes, exercise suits and underwear because of its excellent wicking action. Significantend uses are non-wovens and carpt face yarns. The fibre is also used in upholstery, and industrial fabrics loke filter cloth, bagging, cordage and geotextiles.

v) ***Spandex Fibres :*** The principal end uses include undergarment, support products, ski pants, swimwear, athletic apparel, and other articles where stretch is required.

1.3 Fibre Distribution

Fibres are sold to mills for yarn spinning and weaving or knitting. The farmers who produce natural fibres sell their goods at the market organised by their various

trade associations. On the other hand the large chemical companies that produce man-made fibres have their own sales forces and set prices based on their costs.

Fabric Product Development : Fabric is becoming the driving force of the fashion industry. There are many exciting innovations in fabric especially in blends which create interesting new texture.

1.4 Textile Yarn Production

The word yarn(or thread) is used in common practice to cover all of the linear textile structure, namely spun yarns, filament yarns(mono and multi-filament). Assembled1yarns i.e. folded or plied yarns. Yarns can be either 'single' or 'folded'. Thus a yarn is an assembly of fibres or filaments having a substantial length and relatively small cross-section, with or without twist, being the end-product of a spinning and twisting process.

Assemblies of fibres or filaments which are intermediate products in a spinning process are given special names such as "Sliver", "Roving", "Bave", "Top" or "Tow", depending on the process and the particular intermediate stage.

1.4.1 Classification of Yarns

Yarns can be classified into several categories as follows:

1. Staple Yarns
2. Filament Yarns
   - Multi-filament yarn
   - Monofilament yarn
3. Assembled Yarns
4. Folded or plied Yarns

Spun Yarns are made by mechanical assembly and twisting together (spinning) of staple fibres. From staple fibres such as cotton, flax, wool, spun and noil silk, broken or cut man-made fibres, spun yarns are produced. Fibres from the compressed bales are first opened up and then assembled into a yarn in the following stage:

Loose stock >>>>> Opening & Cleaning >>>>> Orientation >>>>> Sliver formation >>>>> Drawing >>>>> Roving formation >>>>> Yarn formation (Spining)

So, spinning is the final processing stage in the formation of yarns by the spinner and rewind the yarn from the spinning bobbins onto cross-wound cones by the winder in winding machine to obtain larger packages of yarns.

Filament Yarns are made by the assembly of continuous filaments, made from silk or man-made fibres. A multi-Filament Yarn is a filament yarn made from multiple filaments, assembled with or without twist. A monofilament Yarn consists of only a single continuous filament.

Two or more yarns, which are wound side by side onto the same package, but without twisting around each other, are called **assembled yarns.**

Folded or Plied Yarns are yarns made by twisting together two or more single (and/or folded) yarns of the same or different types.

Twist : The term twist stands for both the direction of twisting and the number of turns in a yarn. If the direction of inclination of the fibres appearing at the surface of a yarn (or of the single yarn components of a folded yarn) is to the right, when the yarn is held vertically, then this is called Z-twist.

If the direction of inclination of thefibres appearing at the surface of a yarn (or of the single yarn components of a folded yarn) is to the left, when the yarn is held vertically, then this is called S-twist.

Twist is the number of turns per inch, in single or folded yarns, per unit of length. Highly twisted yarns are used for smooth and dense fabrics. Low twisted yarns have greater volume and are used for rougher and thicker fabrics.

1.4.2 Uses of Various Types of Yarns

Yarns are used for many purposes like for the production of woven fabrics, knitted fabrics, net and laces, braided fabrics, sewing threads, cords, etc.

Uses of yarns can be categorized for many ways as follows:

- Set Texturedyarns yarns made of filament polyester fiber, can be used in many fabrics including gabardine, interlock, and crepe-de-chine.

- Yarns that have the capability of stretching are increasingly being used in textile materials. Aside from the traditional materials used in foundation garments and swimwear, fabrics made from yarns that stretch are being used in apparel to provide increased comfort when sitting bending, stooping, or engaged in active sports or work activities.
- Stretch textured yarn is made primarily from nylon and used extensively in stretch ski pants, stretch hosiery, and similar products. These yarns can be stretched from 30% to 50% of their relaxed length.
- Bare elastic yarns are used in Power stretch fabrics.
- Covered elastic yarns are used in power stretch fabrics
- Core-spun elastic yarns are used in comfprt stretch fabrics because they possess very low recovery force. Stretch chino, a popular cotton sportswear fabric used for tennis shorts and other active sportswear, is made from core-spun cotton yarns.
- Typical novelty yarns are slub, thick and thin, spiral, flock and boucle, etc. Npvelty yarns give fabrics made from them interesting and decorative surface effects. Using novelty yarns is one means by which textile designers can create cloth with raised or nubby surface textures as distinguished from the usual flat surface of most textile materials.
- Chenille yarns are used in woven fabric to produce soft pile-like effects on bedspreads and other decorative fabrics. Chenille yarns have rather low resistance to abrasion, and their use should be avoided in products that will be subjected to even minimal fabric rubbing.
- Metallic yarns are mostly used for decorative rather than functional purposes; a wide range of colours and effects is available.

1.5 Threads

Thread is supplied by yarn producers. Formed by spinning and twisting textile fibres or flaments to gather in to a continuous strand, it is vital in determining the quality of workmanship in a garment. Before the advent of man made fibres cotton and other natural fibre threads met requirements of durability, appearance and

sewability because the majority of fabrics available were also made of natural fibres. However the advent of man made fibres brought about the development of many new fabrics including knitts. Some of the thread choice includes (i) cotton used in cotton and wool garments, (ii) silk used in silk garments and mens wear, (iii) nylon a mono filament used primarily in mens wear, (iv) polyester and polyester blends, (v) Lycra or spandex for streachables and inner garments.

1.5.1 Labels

Labels are the sources of indentification for garments. A label showing fibre content, care instructions and country of origin. The predominant fibre in the garment is listed first along with its content percentage, followed by the other fibres in decreasing order of content. Care instructions are recommended and is very specific. These instructions not only protect the consumer but also protect the manufacturer.

1.5.2 Space

The other elements of color, texture, line and shape, yet as vitally important is the element of space. Essentially, design spaces came in two forms ; two dimensional spaces that can be anything from canvases and billboards to swatches of fabric and three dimensional spaces, such as blocks of wood, pieces of stones, from room interiors to areas in a landscape. In two dimensional art forms, such as drawings, paintings and prints, the artist often want to conveys a feeling of space or depth. Here space is an illusion, for the images rendered on paper, canvas or board are essantially flat. The canest way to creat an illusion of space or distance is through size. Using relative sizes to give a feeling of space or depth is very common to many periods and styles of art. Overlapping is a simple device for creating an illusion of depth. Vertical location is a special device in which elevation on the page or format indicates a recession into depth. Aerial or atmospheric, perspective describes the use of colour or value (dark and light) to shame depth.

All space, within the confines of design is limited. Creations are confined by boundaries demarcated by a given project. These boundaries may be two-dimensional or three dimensional ; they may be structural or visual ; they may be tangible or intangible.

1.5.3 Texture

Texture refers to the surface quality of objects. It is the most sensuous element of design and appeals to our sense of touch. Many art forms have a basic concern with texture and its visual effects. In most of the craft areas texture is an important consideration ceramics, jewellary and furniture design often rely heavily on the texture of the materials to enhance the design effect. In weaving and the textle arts, texture is a primary consideration.

There are two categories of artistic texture - tactile and visual. Tactile refers to the feel or what in fashion partance is called “hand” of a surface. Texture engages three senses. touch, sight and sometimes sound.

Collage : Creating a design by pasting down bits and pieces of coloured and textured papers, cloth or other materials is called collage. This artistic technique has been popular for centuries, mainly in the area of folk art. Only in the 20th century collage has been seriously considered a logotimate medium of the fine arts.

In painting artists can create the impression of texture on a flat, smooth paint surface. By reproducing colour and value patterns of familiar textures, painters can encourage us to see textures where non actually exist. This is called visual textures. The impression of texture is purely visual, it cannot be felt or enjoyed by touch. It is only suggested to our eyes. One of the pleasure of still-life paintaings is the contrast of visual texture. The ultimate point in partraying visual texture is called trompe I’oeil. The French term meaning “to fool the eye”. This style is commonly defined as “depictive painting”.

Texture and Pattern : It would be difficult to draw a strict line between texture and pattern. The word “pattern” mainly associated with printed fabrics such as stripes, polka, dots and floral patterns. Pattern is usually defined as a repetitive design, with the same motif appearing again and again. Textures, too often repeats but its variations. Usually do not involve such perfect regularity. The essential distinction between texture and patterns seems to be whether the surface arouses our sense of touch or merely provides design appealing to the eye. In other world while every texture makes a sort of patterns, not every pattern could be condered as a texture.

1.6 Textile Fibres

Like most of the substances textile fibres are made up of molecules. Fibre molecules are called polymers and the unit of a polymer is termed as menomer. Fibre forming polymers of apparel fibres should be (i) hydrophilic, (ii) chemically resistant, (iii) linear, (iv) long, (v) capable of leing oriented and (vi) able to form high-melting point polymers system. The polymer systems of commonly used apparel fibres are the acrylics cotton, flax, nylon, polyester, viscose, wool to a very large extent meet the above requirements. On the other hand, man-made fibres such as the chloro-fibres, polyethylene and polynopylene fibres are restricted in their apparel use because they do not satisfactorily meet the first, fifth and sixth requirements listed above. Natural celluloise fibres such as coir, hemp, jute and sisal have very restricted apparel use because they are very stiff and uncomfort to wear.

General considerations with regard to fibre properties

(1) Fibre Morphology : Morphology is the study of size, shape and structure of a material or textile fibres and their relationship between these properties.

(a) **Fibre length and thickness :** Fibres are several thousand times longer than their thickness. The length of the most apparel grade fibres ranges from 15mm–115mm. with some exceptions like flax, the thickness of these fibres ranges from about 10μm – 50μm. A filament is a very long fibre. The length of a filament may range from a few 100 meters to several kilometers.

(b) **Fibre length to diameter ratio :** This ratio determines whether or not a fibre is suitable for spinning into yarn. A ratio of 1000:1 or more indicates a fibre which should readily spin into a useful yarn.

(c) **Colour :** Natural fibres and delustred man-made fibres are white to off-white in colour. White or colourless fibres and flaments are preferred because they can be dyed or printed easily.

(d) **Lustre :** This is a subjective measure of the reflection of incident light from a fibre, filament or textile material. Cotton has a convoluted fibre structure and wool a scally surface structure results dullness, whereas more regular and even structure of mercerised cotton and silk gives a distinct lustre.

Fibre tenacity :

The tenacity or strength of a fibre is in general directly related to the length of its polymer, orientation and types of inter-polymer forces of attraction.

Hygroscopic nature :

The hygroscopic nature of a fibre is directly related to the polarity of its polymers and the ratio of its amorphous and crystalline region.

Thermal properties :

The most important thermal property of a textile fibre is the temperature at which it may soften or begin to melt. This temperature is a relative measure of the fibre's heat resistance.

Chemical properties :

This gives an indication of the extent to which the polymers of a fibre may react with the common degreading ofents such as acid, akali, atmospheric pollutant, sunlight etc.

The cellulosic fibres

Cellulosic fibres can be categorised under (i) Natural cellulosic fibres i.e. cotton, flax, jute, kenal, sisal, etc. and (ii) regenerated cellulosic fibre like viscose, cuprammorium etc.

Cotton

Cotton fibre is obtained from a plant and it is classified as a natural, cellulosic, seed, unicellular staple fibre. Under a microscope, a cotton fibre appears as a very fine and regular fibre. Fibre length ranges from 10mm – 65 mm depending upon the quality of the fibre and density of the fibre is 1.52g/cm^3, which makes cotton a rather heavy fibre. The longer the cotton fibre, the earier it is to spin into a smoother and stronger yarn, resulting in a more comfortable, durable and attractive fabric and garments.

The cotton fibre is a single plant cell and has a distinct cuticle, well developed primary and secondary walls, and a lumen.

Properties

1. Cotton fibre is very absorbent and the hygroscopic nature ordinarily prevents cotton textile materials from developing static electricity.

2. Wet strength of cotton fibre is more than its dry strength.
3. Cotton fibres are weakened and destroyed by strong mineral acids.
4. Cotton fibres are resistant to alkalies and are relatively unaffected by normal landering.
5. The most common bleaches used on cotton textile materials are sodium hypochlorite and sodium perborate.
6. The ultraviolet rays of sunlight provide photochemical energy and the infrared rays provide heat energy necessary to degrade the cotton polymers in the presence of atmospheric oxygen, moisture and air pollutants.
7. Cotton in considered to be a relatively easy fibre to dye and print. The classes of dye which they be used to colour cotton are direct, reactive, azuic, vat and sulphur dyes.

The Protein Fibre

Wool fibre :

Wool is a natural ptotein staple fibre having density of 1.31g/cm^3, which tends to make wool a medium weight fibre. Wool fibre in a crimped, fine to thick, regular fibre. Fiber variety of wool have 10 crimps per cm, while the coarser veriety have less than 4 crimps per 10 cm. The crimped configuration prevents wool fibres from aligning themselves too clesely when being spun into yarn. The warmth of wool fabrics is due to the more air spaces in the material then to the fibre. Wool fibres may vary from off white to light cream in colour. This variation in colour in due to the disulphide bonds.

The characteristic longitudival microscopic appearance of wool is the over lapping surface cell structure. These surface cells, known as epithelial cells, and commonly called scales, point towards the tip of the fibre. The scales give the wool fibre a servated surface. Felting of wool is the irreversible shrinkage of the length, breadth and/or thickness of the material and the tendency of wool to felt is a disadvantage of woollen articles of clothing that require frequent loundering.

Polyester fibre

Polyester is a man-made fibre. The most common polyester filament or staple fibre in usually composed of polyethylene terephthalate polymers, polyesters are

medium weight fibre with a density of 1.39 g/cm^3 and due to this polyester textile materials are manufacture as light weight fabrics. Polyester filaments or staple fibrics. Polyester filaments or staple fibres are fine, regular and translucent and have no identifiable microscopic appearance. The longitudiual appearance of the fibre is very regular with circular cross-section.

Properties :

1. Polyester filaments and staple fibres are very strong because of their extremely crystalline polymer system.
2. Polyester filaments and staple fibres are hydrophobic which attracts fats, greases, oils etc.
3. Alkaline conditions as encountered during laundering may hydrolyse the polyester polymers.
4. Normally polyester textile materials do not require any bleaching action.
5. The acid resistance of polyesters help protect polyester textile materials from the slightly acidic conditions that occur in polluted atmosphere.
6. Only disperse dyes are used to dye and print polyester fibres.

Nylon

Nylon is a man-made synthetic polyamide fibres having density 1.14 g/cm^3. The nylon filament or staple fibres display no characteristics microscopic appearance. Nylon filament a staple fibres are not absorbent even though there is a relatively strong attraction for water molecules by the polar amide groups. Nylon is less resistant to acids than it is so alkalis. The amide groups in the nylon polymers are readily hydrolysed under acidic conditions. Prolonged and frequent exposure to alkaline condition cause significant alkali hydrolysis and nylon plymers. Nylon textile materials are inherently white and do not require bleaching. Acid and metal-complex class of dyes are frequently used for dyeing of nylon.

Acrylic fibre

Polyacrylonitrile (PAN) fibres are generally referred to as the acrylic fibres. The acrylic fibres availabe in the market are termed as modified acrylic. These modified acrylic fibres must composed of at least 35% but not more than 85% by weight of

acylaritrile units. The acrylic fibres appear as regular, translucent, slighthy wavy filaments or staple fibres. Acrylic fibres are hydrophobic because the polymer system is highly crystaline. The acrylic fibres are resistant to acid and alkali. Acrylic fibres are not usually bleached in practice and are the most sunlight and weather resistant fibres in common use. Modified acrylic fibre are most commonly dyed with basic dyes.

Flax fibre

Flax fibre is classified as a natural cellulosic, bast and multi-cellular fibre. It has a fibre density of 1.50 g/cm^3 and is considered as heavy fibre. The flax fibre is thick, regular fibre with a subdued lustre. Flax is a very strong fibre and melartic in nature and has an ability to absorb moisture quality.

Viscose fibre

Viscose is a regenerated cellulosic filament or staple fibre. It is a fine, reugular filament or staple fibre. The wet strength of viscose rayon is almost half than its dry strength. The very amorphous polymer system of viscose makes it the most absorbent fibre in common use for apparel. With regard to dyeing and printing viscose absorbs more colour. Reactive, Direct class of dyes are most commonly used for dyeing and printing purpose.

Silk fibre

Silk is a natural protein filament having density of 1.34 g/cm^3, which makes it a medium weight fibre. The raw silk strand consists of two silk filaments encased by a protein called sericin, which makes it thick, uneven and irregular surface and coarse handle. The silk polymer is a linear, fibroin polymer like wool, the repeating unit of silk is the amino acid. The silk filament is strong, but in wet condition it loses strength. Silk is degraded more readily by acids than the wool, wheras alkaline solution cause the silk filament to swell. Chlorine containing bleaching agents are not preferred for bleaching purpose and the resistance of silk to the environement is not as good as that of wool. Acid, metal-complex and reactive class of dyestuffs are most commonly used for dyeing and printing of silk materials.

Relative Importance of Different Fabric Properties as per End-Use Requirement for Diversified Jute and Jute Blended Fabrics

Table : 1. Upholstery

Properties	Relative importance
Abrasion Resistance	***
Light Fastness	***
Thickness	**
Flexural Rigidity	**
Rubbing Fastness	**
Wash Fastness	*
Dimensional Stability	*

Table : 2. Curtains

Properties	Relative importance
Drapability	***
Dimensional Stability	***
Light Fastness	***
Wash Fastness	*
Crease Resistance	*

Table : 3. Table Cloth

Properties	Relative importance
Drapability	***
Wash Fastness	***
Light Fastness	***
Dimensional Stability	**
Crease Resistance	**
Abrasion Resistance	*

Properties	Upholstery	Curtains	Table Cloth	Wall Hanging	Bag Cloth	Blanket	Floor Covering
1. Thickness	**					**	*
2. Strength					***		
3. Abrasion Resistance	***		*				***
4. Drapability		***	***				
5. Flexural Rigidity	**						
6. Bending Rigidity					**		***
7. Dimensional Stability	*	***	**	**	**		
8. Compressibility and Racovery	**		*				**
9. Rubbing Fastness	***	***	***	***	***	**	**
10. Light Fastness	*	*	***		**		
11. Wash Fastness						*	
12. Drycleaning Fastness		*	**				
13. Crease Resistance							
14. Pilling Resistance						**	
15. Thermal Resistance						***	

Table : 4. Wall Hanging

Properties	Relative importance
Light Fastness	***
Dimensional Stability	**

Table : 5. Bag Cloth

Properties	Relative importance
Strenght	***
Light Fastness	***
Dimensional Stability	**
Wash Fastness	**
Bending Rigidity	**

Table : 6. Blanket

Properties	Relative importance
Thermal Resistance	***
Thickness	**
Pilling Resistance	**
Compressibility and Recovery	**
Light Fastness	**
Dry Cleaning Fastness	*

Table : 7. Floor Covering

Properties	Relative importance
Abrasion Resistance	***
Compressibility and Recovery	***
Rubbing Fastness	**
Dimensional Stability	**
Thikness	*

Fibre : Viscose Rayon

Generic Class	:	Rayon (A manufactured fibre composed of regenerated cellulose)
Dry tenacity	:	2.3-2.4 g/d
Wet tenacity	:	1.17-1.27 g/d
Condition extention	:	18.5%
Wet extention	:	13.0%
Moisture regain	:	12-13% (65% R.H & 70°F)
Creep	:	Elasticity of viscose rayon is not high
Specific gravity	:	1.48-1.52
Electrical property	:	Owing to its high moisture absorption, viscose rayon does not lend itself particularly well to insulation purposes.
Birefringence	:	.022
Resistance to light	:	On exposure to light, photocellulose is formed and weakening takes place. Effect of heat : Does not melt, looses strength at 300F and begins to decompose at about 325F.
Chemical properties	:	Acids attack viscose rayon more quickly than they do cotton. At high temperatures acids carbonize viscose.
Biological ressistance	:	Moulds and mildews discolor and weaken viscose rayon.
Susceptibility to bleach	:	(a) Sodium hypochlorite, neutral is the most satisfactory bleach for viscose rayon. (b) Hydrogen peroxide can be used at temperature not exceeding 55°F.
Morphology	:	(a) longitudinal : striated cylinder (b) cross section : serrated
Affinity of dyes	:	direct, reactive, vat, sulphue etc.

Indian Manufacturer

(a) Baroda rayon corp.

(b) Grasim industries ltd.

(c) Century rayon

(d) Indian rayon and industries ltd.

(e) Shriram rayon

Fibre : Ramie

Ramie fibre is obtained from the stem of the plant Boehmeria nivea guad. There are two forms of the ramie plant—the green or Indian ramie and the white or Chinese ramie.

Fibre Morphology : Ramie is an unicellular fibre. The shape of the fibre ultimates as obtained after complete degumming is mainly flat—ribbon like with occasional twists. The shape of the cross-section of ramie fibre is mostly elongated polygonal often with rounded corners.

Tenacity	: 40-50g/tex
Extension at break	: 3-4%
Specific gravity	: 1.51-1.56
Moisture regain at 65% r.h and 70^{o}F	: 12.0%
Degree of crystallinity	: Very high
Orientation angle	: 7^{o} - 8^{o}
Degrading temperature	: 500^{o}F
Discolour temperature	: 250^{o}F
Dye affinity	: Direct, Reactive, Vat, Sulphur.

Fibre : Polypropylene

Generic class : Olefin

A manufactured fibre in which the fibre forming substance is any long chain synthetic polymer composed of atleast 85% by weight of ethylene, propylene or other olefin units.

Tenacity	: 8.5 - 9.0 g/d
Extension at break	: 17 - 20%
Specific gravity	: 0.90 - 0.92

Moisture regain : < 0.05%

Static electricity : Develops static charges

Chemical resistance : Excellent.

Acids and alkalis have very little effect.

Polypropylene is insoluble in cold organic solvents, but will dissolve in hot decaline and tetraline or in boiling tetrachloro-ethane. Trichloroethylene at the boil causes heavy shrinkage.

Abrasion : Resistance to abrasion is good.

Effect of heat : (i) Tg :

(ii) Tm : 165°F

(iii) Ts : 155°F (softening temperature)

Effect of light : Sensitive to oxidation initiated by the action of light.

Affinity to dyestuffs : Pigment

Indian Manufacturer

Alembic chemical works and Co. Ltd.

Gujrat Filaments Ltd.

Rajasthan Petrosynthetics Ltd.

Fibre : Silk

Composition of cultivated raw silk :

Fibroin : 70 - 80%

Sericin : 20 - 30%

Waxy Matter : 0.4 - 0.8%

Carbohydrate : 1.2 - 1.6%

Inorganic Matter : 0.7%

Pigments : 0.2%

Tenacity : 3.5 - 4.5 g/d

Elongation : 18 - 20%

Specific gravity	: 1.33
Moisture regain	: 11.0%
Birefringence	: 0.053
Degrading temperature	: 338°F
Safe Ironing temperature	: 250°F
Degree of crystallinity	: 45 - 50%
Effect of heat	:
Effect of acid and alkali	:
Effect of bleaches and solvent	:
Resistance to mildew aging and sunlight	:
Morphology	: Filaments of silk appears as solid rods with traingular cross-section.
Dye affinity	: Acid, Metal-complex, Reactive, Basic, Natural dyes.

Fibre : Acrylic

A manufactured fibre in which the fibre forming substance is any long chain synthetic polymer composed of atleast 85% by weight of acrylonitrile units.

$(—CH_2—CH_2—)_n$

Breaking tenacity	: 2.2 - 2.3 g/d (std.)
Beaking tenacity	: 1.8 - 2.4 g/d (wet)
Density	: 1.14 - 1.17 g/cc
Birefringenece	: –0.004
Moisture regain	: 1.5% (at 65% r.h and 70°F)
Melting point	: Does not melt, decomposes with discoloration
Breaking elongation	: 40 - 55% (std.)
	: 40 - 60% (wet)
Elastic recovery	: 99 at 2%
	: 89 at 5%
Average stiffness	: 5 - 7 g/d
Average toughness	: 0.4 - 0.5 g-cm.

Effect of acids and alkalis	:	Good to excellent resistance to mineral acids. Fair to good resistance to weak alkalis.
Effect of bleaches and solvents	:	Good resistance to bleaches and common solvents.
Resistance to mildew, aging, sunlight, abrasion	:	Excellent resistance to mildew, aging and sunlight. Good resistance to abrasion.
Dye affinity	:	Disperse and Cationic
Cross-sectional shape	:	(i) nearly round (ii) dumbbell or lima been-shaped (iii) elongated dumbells or wavy ribbons

Textile designers generally create print designs for fabrics or suggest styling ideas for a weave or knitt. They work hand in hand with textile engineers and have to understand textile processes to know if their ideas will work. Textile designers must consider the essential elements of colour, texture, line, shape and space. The primerily coucerned is a two diamentional surface i.e. flat fabric rather than with the three diamention human form. They may use CAD systems to help them experiment with visual rerpesentations of weave and pattern designs when designing a collection of fabrics to present to their customers.

Textile fabrics can be made from yarns/fibres by the following routes:

a) From Yarns:
   - Woven
   - Knits
   - Braids
   - Open-work
   - Stitched

b) From Fibres
   - Nonwovens

     (felted, needled, adhesive bonded)

c) From combinations of fibres and yarns

- Stitch-bonded
- Laminated

Woven fabrics are made by the interlacing of two sets of yarns, disposed at right angles.

Knitted fabrics are made by the interlocking of loops of yarn (s). In weft knitted fabrics, the loops are formed by yarns traversing across the fabric width. In warp knitted fabrics, the loops are formed by a set of yarns disposed along the fabric length.

Open-work fabrics such as lace and net can be made by various techniques such as leno, bobbinet, and warp knitting.

Braid is made by the interlacing of at least three yarns in a diagonal pattern.

Nonwoven fabrics are made directly from fibres, with no intermediate stages. Webs, or batts are given strength by mechanical entanglement or adhesive bonding of the fibres.

Wool felts are made by entanglement of wool or other animal hairs by the felting action of hear, moisture, and agitation.

Stitch bonding can be used to make fabrics from several types of fidre assembly, including webs, silvers, rovings or yarns.

Laminate fabrics are made by the adhesive bonding of two or more fabrics, or by bonding fabrics to foam, film, or paper.

1.7 Summary

Fibres are the smallest part of the fabric. They are fine, hair-like substances, categorized as either natural or manufactured. Cotton, which grows on a plant, and wool, which is shorn from a sheep, are examples of natural fibres. Manufactured fibres are created from chemicals and include acrylic, nylon and polyester. Chemical companies produce them. Textile fibres can also be classified into Coarse, Fine, and Microfibres. Apparel fabrics are usually made from fine and microfibres. Finer fibres make softer, denser and more comfortable fabrics, with better drape.

Textile yarns are, by definition, groups of fibres twisted together to form a continuous strand. All textile fabrics, except for a few, such as felt and nonwoven

fabrics, are produced from yarns. The yarns are interlace(woven), interloped (knitting) or combined in other ways tofrom a textile fabric. There are many types of yarns, some lustrous, some dull, some smooth, some rough, some thinner than human hair, some thick and bulky, etc.. Two fabrics each made from the same fibre(e.g. cotton) and each woven in the same weave (twill weave) may be substantially different from one another in appearance, durability, and cleanability due to the yarn difference in each of the fibres.

Woven fabrics are made by interlacing two sets of yarns at right angles to each other. The length-wise yarns are known as warp yarns or ends, and the width-wise yarns are known as Weft (filling yarns, or picks). The length-wise edges of the fabric are the selvedges. The selvedge is easily distinguishable from the rest of the material.

1.8 Reference Book

Handbook of textile fibres – J Gordon Cook, Merrow

1.9 Assessment

1. How fibres can be identified?
2. Classify textile fibres according to end uses.
3. What is yarn? Classify yarn types.
4. What is weaving?
5. Compare different types of fabrics made from different manufacturing processes in terms of production.