Printing Outline

- Introduction
- Classification
- Printing Methods
  - Hand Printing
  - Mechanized Printing
- Types of Prints
  - Applied
  - Resist
  - Discharge
  - Other
- Patterns
- Print Defects
Introduction

- **Textile printing** is the application of dye, pigment, or other chemicals to produce designs on yarn, fabric, or other textile products.

- Dyes are fiber specific; pigments can be used on any fiber. Resin binders in pigment paste “bind” the pigment to the fabric.

- Selecting a colorant depends on fiber, design, print method, quantity printed, end use, and cost.

- As with dyeing, colorant type affects the performance of printed fabrics:
  - Reactive dyes are not colorfast to bleach; pigments are not damaged by bleach.
  - Dyes do not affect fabric hand; pigment prints may be stiff.
Note: Burn-out and flocking are included under finishing.
Printing Methods

- Fabrics can be hand or machine printed.

- Ancient hand printing techniques were developed in various regions of the world. They are labor-intensive processes.

- Over time, some hand printing techniques have been refined and mechanized for mass production:
  - Stencil printing evolved into hand screen printing, then into semi-automated and automated screen printing with flat screens. Rotary screen printing was developed by changing the shape of the screen from flat to cylindrical.
  - Blocks are used to stamp wax on fabric for batik; some artists/printers use linoleum for block printing.

- Mechanized printing methods are used to print most printed textiles available today.
Hand Printing

- **Hand printing** methods:
  - **Block** and **screen** printing methods are direct printing methods in which the print paste is applied directly to the fabric.
  - **Batik**, **tie-dye**, and **ikat** are resist printing methods in which parts that are protected do not get colored. Hand printing plays an important role in cottage industries around the world.
  - **Screen** printing is used for printing items such as T-shirts, tote bags, and other items.

- Cotton and silk fabrics are typically used for hand printing. Other fibers such as jute, rayon, and wool are also used.

- Hand printing is of interest to fiber artists, as many unique items can be created using these methods.
Block Printing

- Block printing is a direct hand printing method using wood or other carved material to stamp designs on fabric.
- Traditional block printed fabrics are popular around the world.
- Block printing with dye paste is typically done on cellulosic and protein fibers. Pigments can be used to print other fibers.
- The size of the repeat pattern is limited by the size of the block.
Tie-Dye

- Tie-dye is a resist printing method; the fabric is tied to prevent (or resist) dye penetration.
- Tie-dye is used for traditional textiles in India, Japan, Nigeria, Ghana, and Liberia.
- Cellulosic fabrics (cotton, rayon, silk) are generally used for tie-dye.
Cotton Fabric Tie-dyed Using Shibori Technique

Note: Shibori is the traditional Japanese method of tie-dye. Arashi shibori is a subgroup in which the design is created by winding long pieces of fabric around a pole and then wrapping it with thread and scrunching the wrapped fabric to create the design. The design in this fabric is a modification of the arashi shibori technique.
**Ikat**

- **Ikat** is a resist printing method where yarns are tie-dyed prior to hand weaving.

- Colored shapes with irregular edges are characteristic of ikat printing.

- Ikat is used for printing traditional textiles in Indonesia, India, and Guatemala. Ikat motifs and colors vary considerably in different regions.

- Cotton and silk yarns are used to produce ikat fabrics.
Double Ikat – Woven with tie-dyed warp and filling yarns

tie-dyed warp yarns on the loom

woven fabric
Comparison of Ikat and Imitation Ikat Print

This is an ikat fabric with warp yarns tied-dyed before the fabric was woven.

This is a jacquard with the ikat design printed on the fabric.
Batik

- **Batik** is produced by applying hot wax to fabric prior to dyeing to prevent dye penetration in certain areas.

- True batiks show cracks of color where the wax cracked and the dye penetrated.

- Traditionally, batik is done on cotton and silk fabrics; now, rayon is also used.
Tools Used to Apply Wax in Batik Printing – A tjanting was used for outlining and a brush for filling in the wax on a napkin.
Steps in Batik Printing

- Tracing the design
- Applying wax
- Dyeing (applied on fabric or fabric immersed in a dye bath)
- Allowing time for dye penetration
- Removing wax
- Recycling wax

Photographed with permission of Baobab Batik (Swaziland)
Screen Printing

- **Screen printing** is stencil printing where the print paste is pressed through a fine screen to apply a design. The sections of the screen that should block color from passing to the fabric are covered with an impermeable material.

- Print paste typically consists of a dye or pigment with thickener added to get the desired consistency.

- Small flat screens are used for printing small areas (T-shirts, etc.) using manual and semi-mechanized machines.
Flatbed Hand Screen Printing – The workers are aligning the screen as they print the background color.
Mechanized Printing

- **Mechanized printing** can be categorized into:
  - Roller
  - Screen (flatbed, rotary)
  - Heat transfer
  - Other techniques

- Cost, quantity, design type and size, fiber content, and fabric construction must be considered when selecting printing technique.

- For most mechanized printing methods, design and color matching are computerized.
Roller Printing

- **Roller printing** is a fast process historically used to print large quantities of fabric.
  - It is not suitable for smaller quantities as initial set-up costs (engraving copper rollers) are very high and labor-intensive.

- The process is suitable for stripes, polka dots, and fine-line designs (e.g., paisleys) where the design repeat is not more than the diameter of the roller.

- Care must be taken when printing knits to ensure the fabric does not stretch, resulting in design smudges.

- Roller printing has mostly been replaced by rotary screen printing. Polka dots, stripes, and small designs typically roller printed in the past are now rotary screen printed by machine.
Roller Printed Knitted Fabric with Fine-line Design
Screen Printing

- **Screen printing** by hand was automated to increase production.

- Screens are made of mesh with high fabric count. Nylon and polyester are used for flat screens (manual, semi-automatic, and automatic processes); wire mesh is used for rotary screens.

- **Print paste** for screen printing is prepared using dyes, pigments and thickeners so that the viscosity is correct.

- **Plastisol** inks coat the surface and give prints an opaque look. They are suitable for knits (T-shirts, sweatshirts) as plastisol coating does not crack when stretched. Additives in plastisol create special effects:
  - Foam expanding inks, known as puff inks, make the design “puff up” during curing.
  - Silver or gold flakes make the design glitter.
  - Plastisol suede ink gives the print a soft surface.
Print Paste

Note: Water-soluble print base and yellow pigment print paste used for screen printing.
Flatbed Screen Printing

- Flatbed screens are used to print wide widths of fabric.
- Fabric resting on a conveyor belt is mechanically advanced from screen to screen.
- The process is not suitable for vertical or diagonal lines as the lines are difficult to match.
Rotary Screen Printing

- **Rotary screen printing**
  - Most common printing method
  - Simple and more cost-effective than roller printing

- Used to print a variety of fabrics (including knits) and designs from single-color polka dots to sixteen-color half-tone patterns; it easily prints vertical and diagonal stripes that are difficult to print on a flatbed machine.

- **Registry marks** along the selvage used to align the rotary screens identify fabrics printed by this method. Note: Not all screen printed fabrics have registry marks.

- Reactive dyes, vat dyes, and pigments are commonly used for rotary screen printing.
The print paste is pressed against the inside of the rotary screen with a squeegee. The paste that passes through the screen prints the design on the fabric.
Transfer Printing

- **Transfer printing**
  - Design on paper is transferred to fabric.
  - **Heat** transfer printing requires applying heat and pressure.
  - Low temperatures are required for **adhesive**-backed, plastisol transfers.

- The durability of the design to cleaning and use depends on the colorant, temperature, and pressure applied to transfer the design.
  - Some prints may pucker, peel, or crack during normal use.
Heat Transfer Printing

- The process was developed to print **polyester** fabrics with disperse dyes.
  - Disperse dyes **sublimate** (change from solid to gas phase) when heated, and are easily transferred from paper to fabric.
- Rotary heat transfer printing machines are used for printing wide-width fabrics as well as cut pieces for apparel.
- Heat transfer printing can be used to print a wide variety of patterns including half-tones, large prints, and fine-line designs since they are first printed on paper.
- The initial start-up cost is very low, and the changeover time to print a new design is very short.
- The process is considered environmentally friendly as the energy use is low and there is less waste.
Rotary Heat Transfer Printer Used for Sublimation Dye Printing

Note: This heat transfer printer allows for printing of cut garment pieces.

Courtesy Advanced Innovative Technologies, L.L.C.
Heat Transfer Printing Process

- Screen or digital printing is used to print designs on transfer paper; some systems can use regular paper.
- **Fabric** and **preprinted paper** are pressed together in a heated press.
- Dyes from the paper are transferred to the fabric.
Digital Printing

- Digital printing is similar to inkjet printing on paper; regular and wide-format printers are used to print the designs on fabrics prepared for digital printing.
- The eco-friendly process creates customized designs at a relatively low cost. The process can be used to print a large variety of designs including half-tones, large prints, and fine-line designs.
- Dyes and pigments are used to produce inks for digital printing. Ink is selected based on the fiber content of the fabric.
  - Reactive dyes are used for cellulosic fabrics, acid for protein and nylon, and disperse for polyester.
  - Pigment inks can be used for printing fabrics with any fiber content.
- Digital printing is suitable for printing small yardage/quantities.
  - Small printers are used for printing T-shirts and promotional items.
  - Wide-format printers are used by design studios and print to order companies.
  - It is also used for developing samples for screen printing.
Digital Printing

Photographed with permission of Spoonflower Inc.
Digital Printing Used for Printing Upholstery Fabric

Note: Digital printing is used for producing print to order fabrics. Customers have the option of providing their own design for pigment printed fabrics.

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