Overview of Printing Processes
What is a printing process?

• A reproduction of quantities of images that can be seen or perceived visually

• Plate or plateless printing systems

• Each end use requirement is different
  ○ All printed products are unique in some fashion
  ○ It may be how they look, feel, or function
We’ve come a long way

From the very early days when books were produced by handwriting copies…

To today’s high quality, high speed multicolor reproductions utilizing high speed offset printing presses
The major ink-based printing processes include:

- **Relief:** Letterpress & Flexography – print areas above the non-print areas
- **Intaglio:** Gravure & Engraving – print areas below the non-print areas
- **Porous:** Screen printing – print areas are on fine mesh screens
- **Planographic:** Lithography – print and non-print areas are on the same surface.
Relief process - Letterpress

- The first printing process
- Pi Sheng invents moveable type in China about A.D. 1000 using clay blocks
- Johannes Gutenberg invents moveable type in Germany in 1452 using metal
Relief process: Letterpress

- A raised surface takes ink; image transfers directly to paper
- Oldest of the major processes and is relatively obsolete
Letterpress

Advantages and disadvantages

- There really are no advantages today, except perhaps aesthetically.
- A major disadvantage is cumbersome image carrier preparation.
- Hard to proofread in carrier.
Relief process: Flexography

- Flexography is used primarily in the packaging industry.
- Flexography is a relief process that uses a flexible rubber or plastic plate.
The flexographic process

• A form of letterpress (relief) using flexible rubber/plastic plate
• Image areas that receive ink are raised above the nonimage area
• Ink comes into direct contact with substrate
Flexography

• Advantages and disadvantages
  ○ Flexo’s strengths include the ability to print on a diverse range of substrates, including non-absorbent substrates like foils and plastics, and on irregular surfaces
  ○ Disadvantages include a longer plate preparation time and relatively slow presses when compared to other print processes
Intaglio process: Gravure

• The gravure process is used to print U.S. currency
Gravure

Image areas are etched (or carved) below the surface

- Relies on the use of engraved cylinders to transfer ink to paper
The gravure process

• Ink is picked up in cells on surface of metal cylinder
• Excess ink is removed with doctor blade
• The ink remaining in the cells is transferred to the substrate
Gravure

• Advantages and disadvantages
  ○ Consistent process that can reproduce very fine details
  ○ But the high cost of engraving cylinders limits its use to long runs

Gravure printing press
Porous: Screen printing

- Used for printing such items as T-shirts, sheets, and other fabrics, as well as glasses, mugs, wallcoverings, linoleum, and computer circuit boards
Screen printing

- A squeegee forces ink through a porous mesh or screen
- The screen is covered by a stencil that blocks nonimage areas
The basics of screen printing

- Film positive
- Light-sensitive emulsion
- Frame with screen
- Squeegee
- Emulsion attached to screen with stencil image
- Printed product
Automatic screen printer

Ink is moved across the screen on the flood stroke...

...then pushed through the screen with a squeegee on the print stroke
Screen printing

• Advantages and disadvantages
  o Ability to print on almost any substrate, including three-dimensional surfaces
  o Very thick ink film, allowing for colorful, highly durable products
  o Cost effective, even with low quantities
  o However, very fine lines and small dots are difficult to reproduce, and the production speed is slow
Planographic: Offset Lithography

• Lithography is popular primarily in the commercial printing industry
  ○ Printed products include magazines, books, brochures, annual reports, and newsletters
Lithography

• The lithographic process is based on the principle that ink and water do not readily mix
  o The image area is oleophilic (ink-loving)
  o The nonimage area is hydrophilic (water-loving)

• The surface of the plate is planographic
  o The image area is no higher or lower than the nonimage area
Printing press units

- Printing just one color of ink with an offset press requires ink, water, plate, blanket, and impression cylinders
  - This collection of items is called a press unit
How it works

• A plate is processed with the image. One plate is needed for each color. The plate is wrapped around the cylinder of a printing press
How it works

• The nonimage area of the plate is dampened and the image area of the plate in inked.

• The image (right reading) is offset to the blanket (wrong reading) and then offset to the paper (right reading).
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Lithography

• Advantages of lithography include:
  o Cost-effective for large quantities
  o Ability to print on a variety of substrates

• Disadvantages include:
  o Dealing with ink-water balance on press can be difficult
  o Capital investment
Non-impact and digital

• A number of digital printing processes have emerged in recent years — inkjet printing and xerography, among others.

• Referred to as non-impact printing because no force of contact is required to transfer the image to the substrate.
Non-impact and digital

• Commonly used for short-run jobs
• Sometimes referred to as on-demand since jobs can be printed as needed
• Common products:
  - Books, fliers, newsletters, color proofs, banners, labels, and signs
How it works

- Selenium drum
- Positive charge
- Negative charge
- Toner particles (negative charge)
Non-impact and digital

• Advantages
  o Short notice
  o Quick turnaround
  o Short, economical production
  o Variable/personalized content

• Disadvantages
  o Size limitations, 11”x17” on many devices
  o Toner and not ink
Print merging with technology

• **QR codes**
  - Scan for additional information
  - Redirects to website

• **Augmented Reality**
  - View a physical environment with computer-generated graphics, including video and sound.
  - Simple use: 1<sup>st</sup> down markers during football games
  - Can use smart phones and tablets, with or without print
In conclusion...

• There’s a place for each printing process in today’s market
• The diversity of printed products in our world necessitates the existence of all the printing processes available to us
• Print and technology blend for unlimited experiences