

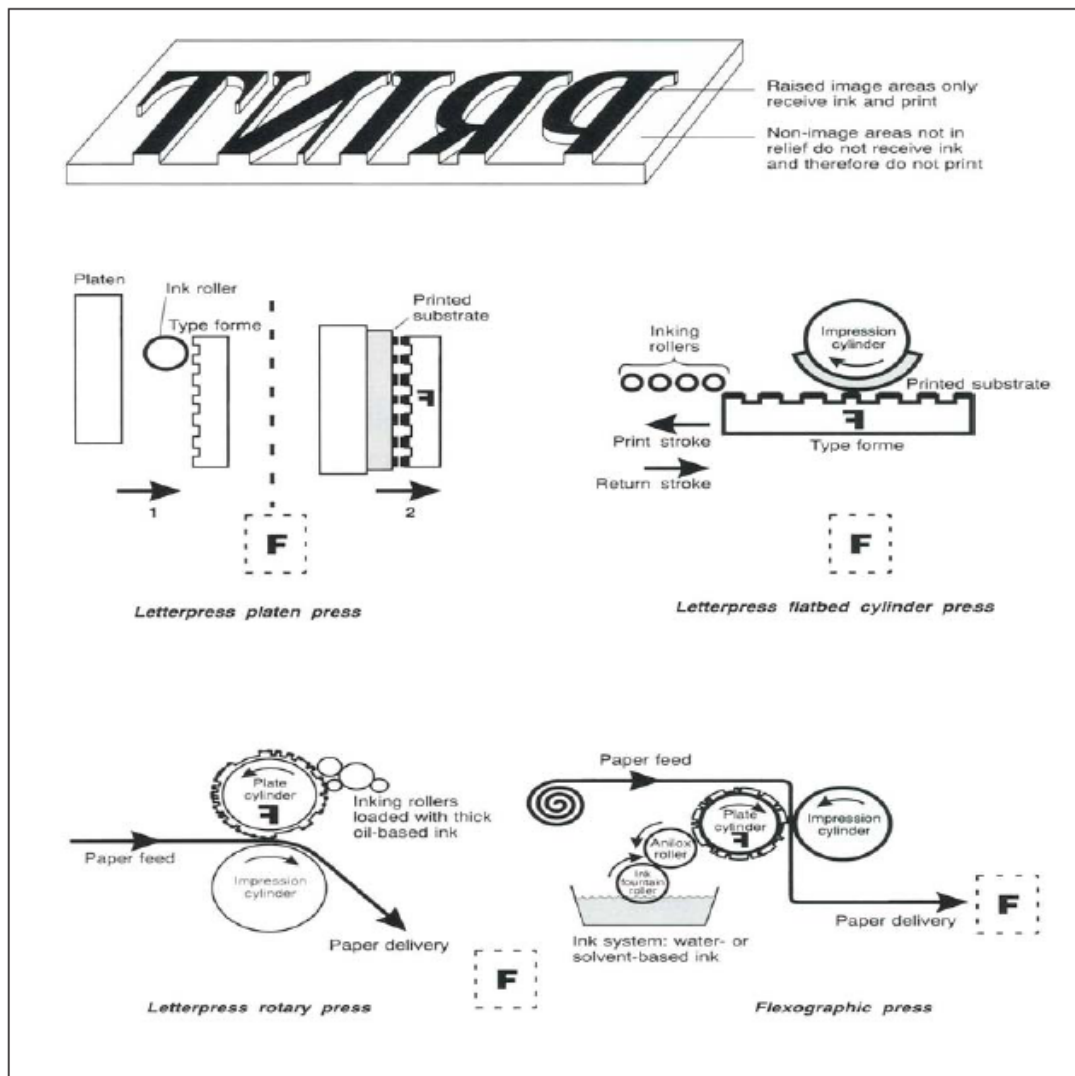
## Unit II

### PRINCIPLES OF PRINTING PROCESSES

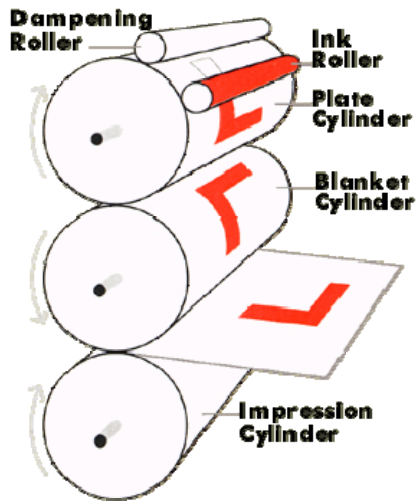
#### 2.1. PRINCIPLES OF LETTERPRESS, OFFSET, FLEXOGRAPHY, GRAVURE, SCREEN PRINTING AND DIGITAL PRINTING PROCESSES

##### Letter Press Printing (Relief printing)

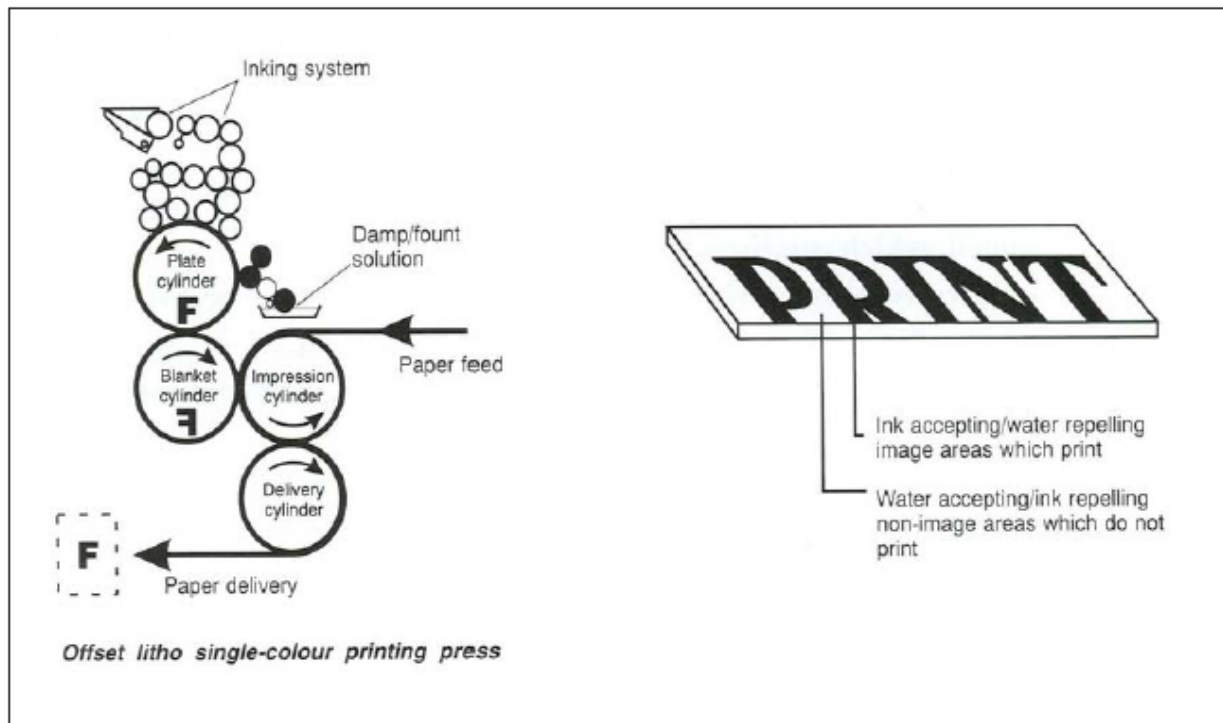
**Letterpress (Relief) Printing :** Here, the printing elements i.e., image area (letters, lines, dots, etc.) are in raised form. When the printing plate is inked, the ink adheres to the raised image area (printing parts) and is then transferred under pressure onto the printing substrate. The main examples of this printing technology are *letterpress* which, until a few decades ago, was the dominant printing technology and *flexography* which, by the middle of this century, had started to be used more and more in packaging printing. With traditional letterpress printing a hard metal printing plate (lead) is used and in flexography a flexible, soft rubber or plastic plate is employed. - see Figure :



**Planographic printing**



**Offset (Lithography) Printing :** Here, the image area and non-image area lie in the same level; but are usually made from different materials (e.g., aluminum and polymer coating) with different chemical and physical surface properties. During printing, the non-image areas are treated to receive water and made ink-repellent first (by wetting) and the plate is then inked so that the ink is taken up only by the image areas. The main example of lithography is *offset printing*, which is today the dominant printing technology. Offset printing is an indirect printing technology, that is, the ink is first transferred to an intermediate carrier (rubber blanket) and from there onto the substrate. *see Figure 1.*

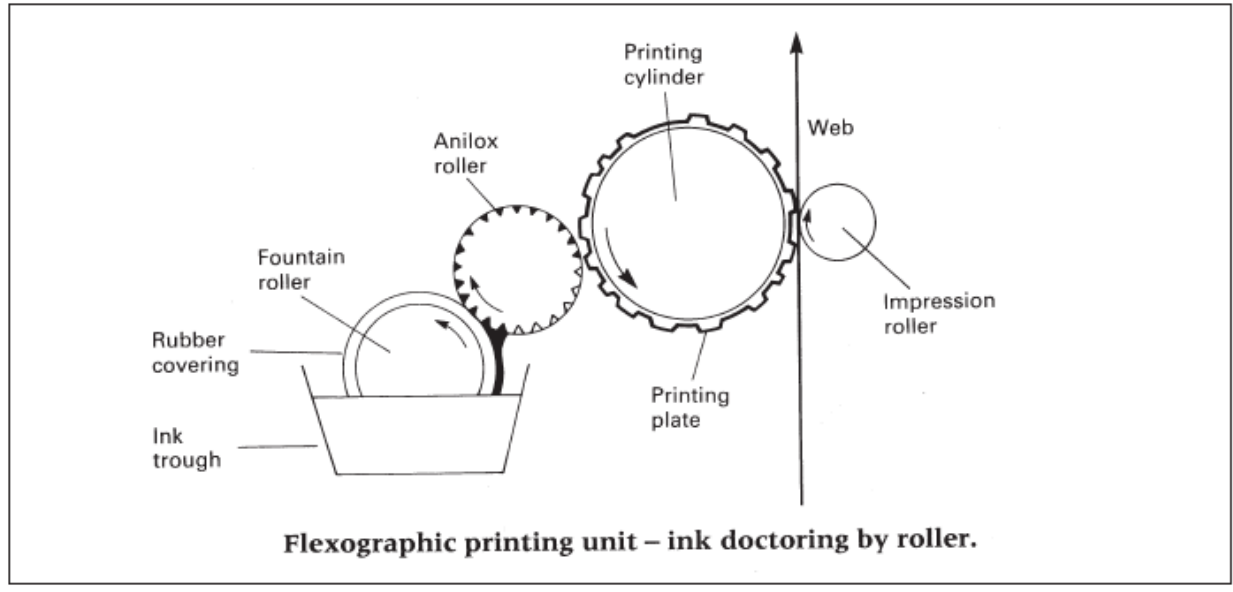


*Planographic printing*

**Flexographic printing**

Flexography is a process in which the printing image stands up in relief. A liquid is used which may be solvent-based, and dries mainly by solvent evaporation. Water-based inks are also widely used, and UV-cured systems are being introduced.

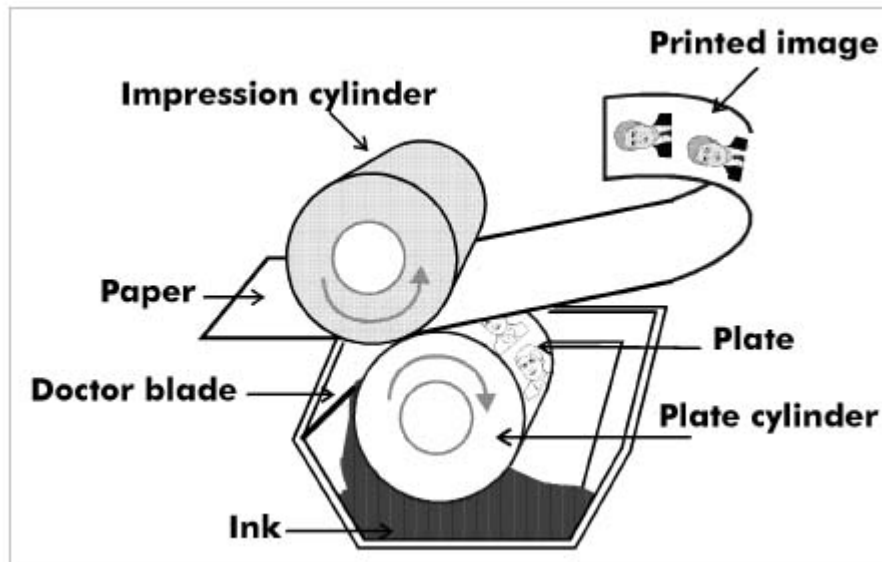
A low printing pressure is essential to the process because of the combination of very fluid inks and soft, flexible printing plates that are used. The process has several distinctive features.



**Gravure printing**

**Gravure Printing :** In this type of printing, the printing areas are in recess - that is, on a lower level than the non-printing surface. The recesses are filled with ink and surplus ink is removed from the non-printing surface by doctor blade. The substrate is then pressed against the printing cylinder to transfer the ink onto it. The main examples of gravure printing are Rotogravure printing and, in the area of arts and crafts, copper plate engraving and die-stamping (also security printing).

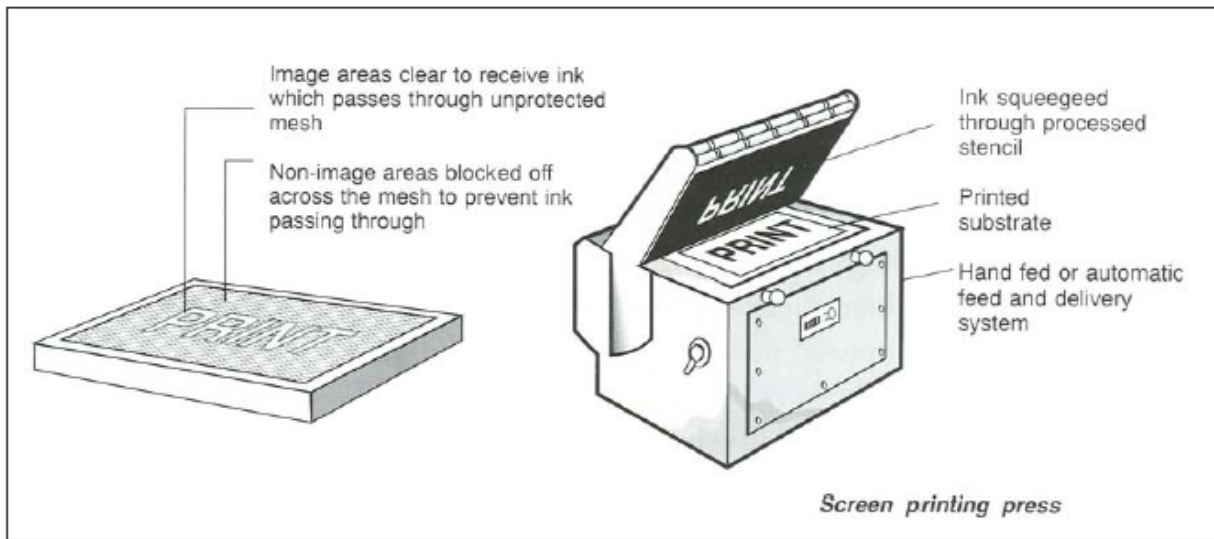
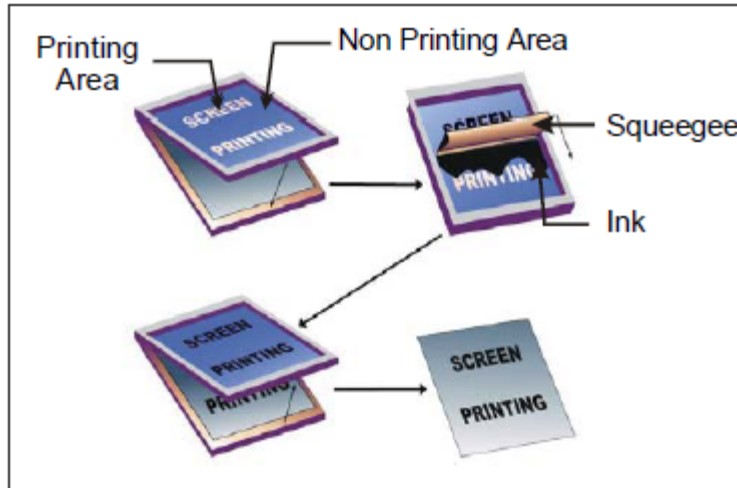
*Gravure* is an example of the intaglio printing process.



**Screen Printing (Stencil printing):**

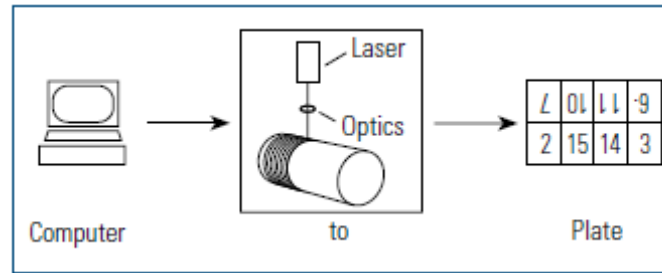
In this type of printing, the image and non-image areas are carried on a mesh(woven) screen, the image areas being open or ‘unblocked’ in the form of a stencil. The non-image areas are formed by ‘blocking out’ the mesh by coating. The paper is placed under the screen. After the screen is lowered into contact with the paper, ink is passed across the upper surface of the screen. Where the screen is open, ink goes through to the paper beneath.

Screen printing is an example of the stencil printing process.



**Digital Printing:**

Digital printing is generally defined as any type of print reproduction method that utilizes electronic files to produce a printed piece from spots and dots of ink, toner, or dye. Applying it to the print workflow has eliminated most of the manual steps involved with conventional print processes.



Digital printing technology can be divided into two main classifications: **Variable Imaging and Direct Imaging.**

- **Computer-to-Plate**
- **Computer-to-Print**
- **Computer-to-Press**

## **2.2. PRINT RECOGNITION OF PRINTING PROCESSES**

It is undoubtedly a considerable asset to be able to determine with reasonable accuracy the printing process or processes by which an item of printed matter has been produced.

There are a number of characteristics or clues which, if they can be discerned, make identification of the process possible, but not necessarily simple. Indeed, there are some jobs where it is very difficult to identify the relevant process or processes, even to those having considerable experience, and the use of a powerful magnifying glass or 'linen tester' is of considerable value.

### **Offset Printing**

- Overall, smooth and even printed result
- Very wide range of substrates including coarse textures, can be satisfactorily printed, even when very fine halftone illustrations are reproduced
- Tonal effects obtained by the use of mechanical tints or halftones.

### **Flexography Printing**

- Thickening of design under pressure, along with a general outline to the printed areas in the form of a visible halo, especially around the outer edges
- Tonal effects obtained by the use of mechanical tints or halftones
- Fine-screen halftones must have substrate with a coated surface
- Printed samples often obtained from processed material in reel-form such as self-adhesive labels, plastic and paper wrappings.

### **Letterpress Printing**

- Thickening of design under pressure, along with a general outline to the printed areas in the form of a visible halo, especially around the outer edges

- Slight embossed effect usually detectable on reverse of sheet, especially with sheetfed printing.
- Tonal effects obtained by the use of mechanical tints or halftone dot
- Fine-screen halftones must have substrate with a coated surface.

### **Gravure Printing**

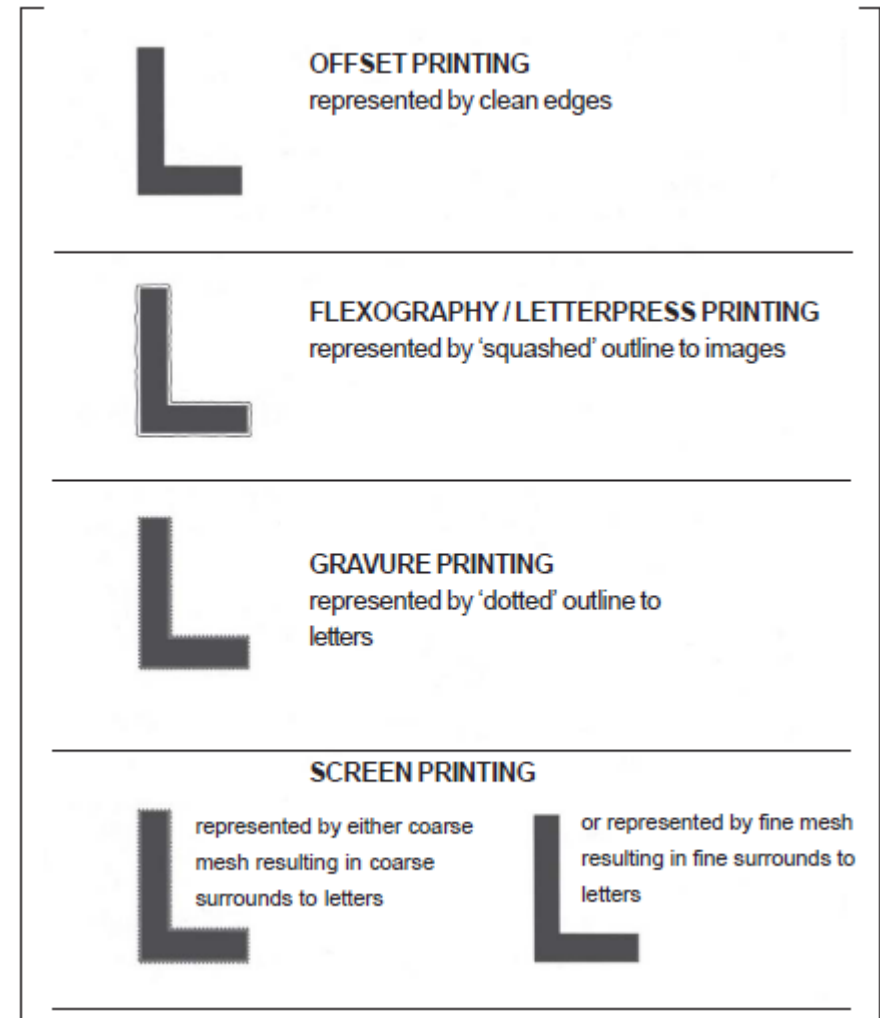
- Wide range of tonal values is possible, giving an effect of continuous tone-like quality (especially in four-colour process work)
- Because of the screen pattern or cell structure, which appears over the whole of the printed image, fine-line work and text matter appear rough/broken at the edges when examined with a magnifying glass
- Under a magnifying glass the 'screen pattern' in conventional gravure is seen to be of a regular square formation (showing uniform cells).

### **Screen Printing**

- Thickness of ink film is usually more apparent than in other processes, especially where solid colours are printed upon one another.
- Because of the use of relatively coarse screen meshes, forming the support for the stencil, small lettering and fine-line work tends to break up round the edges and this can be identified when examined with a magnifying glass.

### **Digital Printing**

- Overall, smooth and even printed result.
- Fine-screen halftones must have substrate with a coated surface.
- Printed samples often obtained from processed material in reel-form such as self-adhesive labels, plastic and paper wrappings.



**Visual identification of different printing processes**

When viewing a printed sample it is often difficult to tell which process has been used simply by looking at it with the naked eye. However, if a printed sample of the text area is examined with the use of a magnifying glass, the following characteristics are visible.

- **Clean edges around Lithographic print**
- **Outline edges around Flexographic/Letterpress print**
- **Dotted edges around Gravure print**
- **Coarse/dotted edges or clean edges around Screen print, depending on screen mesh used**

**1.3. ADVANTAGES AND LIMITATIONS (DISADVANTAGES) OF THE MAIN PRINTING PROCESSES**

**Offset Printing**

***Advantages***

- Suitable for a very wide range of work, from short- to long-run
- Wide range of substrates able to be printed to a high standard
- Fine screen and high definition printed work even on relatively coarse substrates
- Wide range of printing plate material available to suit different applications and requirements - eg
  - paper and plastic/polyester plates used mainly for small -offset, short-run applications in generally non-process work,
  - negative- working and positive working presensitised metal plates used mainly for high quality, fine definition work
- High definition reproduction of typematter, line and tone illustrations
- Widest range of presses available of all the printing processes
- Machine speeds generally competitive across a wide range of printing quantities
- Convenient to store films or plates for possible reprints.

***Limitations (Disadvantages)***

- Alterations to machine plates impracticable
- Care must be exercised in ensuring the printed quality is maintained by adjusting and controlling the ink and water balance
- Being very much a chemical-based process it is coming under increasingly greater environmental pressures to adopt 'greener' processing practices.

**Flexography Printing**

***Advantages***

- Changes to plates can be made relatively easily and cheaply, by just replacing the required parts of the overall image areas
- Ideally suited to printing reel/web-fed substrates with in-line press finishing
- An environmentally friendly process as it tends to use few chemicals, in fact is often operated as an entirely water-based process in terms of consumables, such as plate processing, inks and cleaning fluids
- Simple, generally easy to use process
- Variable cylinder cut-offs allow greater flexibility on the length of images that can be printed.

***Limitations (Disadvantages)***

- Cannot print screen halftones as fine as offset printing, requiring a smooth to coated stock to reproduce good screen detail



- Not economic for sheet-fed printing, therefore unsuitable for short-run general commercial printed products such as booklets and leaflets
- Although print quality has improved considerably in recent years, it is still not as high as offset lithography.

### **Letterpress Printing**

#### ***Advantages***

- Versatility in regard to late corrections such as names, prices, changes of illustrations, etc.
- Numbering machines can be used and printed perforations can be included in type formes
- Economic for short runs and overprinting
- Ideal for cutting-and-creasing, foil blocking and embossing on adapted presses.

#### ***Limitations (Disadvantages)***

- Gloss coated paper necessary for fine-screen halftones
- Storage of bulky type metal or formes expensive, although photo polymer plates now mainly used
- Relatively slow running speeds - ie - reciprocation presses compared to other processes, except screen.

### **Photogravure Printing**

#### ***Advantages***

- A printing process giving full colour values in reproduction, with rich tonal effects, particularly in monochrome
- High production speeds is of great advantage in periodical, magazine, catalogue and colour supplement work printing, where very long runs are often required
- High quality printed results, especially in colour work, on relatively inexpensive grades of substrates which cannot be matched by other printing processes
- Variable cylinder cut-offs allow much more flexibility on available pagination range for publications compared to heat-set offset litho.

#### ***Limitations (Disadvantages)***

- Printing cylinders very expensive
- Alterations to plates or cylinders impracticable
- Type matter and fine-line detail is broken up by the overall cell structure
- Make-ready / set-up costs expensive, which along with high costs of printing cylinders makes gravure unsuitable for short- or medium-sized run jobs.

## **Screen Printing**

### ***Advantages***

- Suitable for short runs multi-colour jobs.
- Low preparatory costs
- Light colours can be printed satisfactorily on dark materials or deep colours
- Ideally suited for printing showcards, posters and unusual & irregular materials such as heavy gauge metal, plastic, glass, etc
- Lays down the heaviest ink film thickness of all the printing processes, resulting in enhanced results such as very high gloss varnishing and raised printing results when required.

### ***Limitations (Disadvantages)***

- Halftone subjects are limited to coarse screens
- Although automatic presses are now available, the process is still in the main restricted to short-run work
- Conventional inks requires some considerable time, plus use of space consuming racking, to allow the work to dry, leading to the increased use of UV inks.

## **DIGITAL PRINTING:**

### **Advantages**

1. Digital printing requires minimal press setup and has multicolor registration built-in to its system.
2. Most digital print processing requires less or no color overlap or trapping.
3. Digital printing does not use film masters, stencils, screens or plates. It requires much less space for archiving text and images than analog printing methods require.
4. Digital printing uses less hazardous chemicals, produces less waste and results in less negative environmental impact than analog technologies.
5. Digital printing is employing sophisticated color matching and calibration technology to produce accurate process color matching.
6. Digital web printers can print images limited only by the width of fabric and the length of the bolt or roll. They can print panoramas and are not restricted to repeat patterns.
7. Digital files are usually easier and quicker to edit and modify than analog photographic images.
8. Designers, artists, photographers, architects, and drafts people are increasingly creating and reproducing their work digitally.

### **Disadvantages**

1. Most digital technologies have slower throughput as compared with comparable analog printing.

2. Digital printing will often cost more per copy than analog printing for longer print runs.
3. It often requires specially prepared and coated substrates.
4. Most digital printing technologies deposit very thin ink or toner layers. These limits necessitate layering for applications requiring thicker deposits, resulting in slower operation.
5. Digital inks and toners are limited in capacity and carry high price tags.