
UNIT 14 MATERIAL REPAIR

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14.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the basic repair techniques;
- discussed the various materials and tools required for carrying out simple book repair procedures;
- learn about cleaning, stain removal and other treatment techniques;
- learn about the technique to flatten folded or rolled paper documents by humidification; and
- discuss techniques for repair of audio and video cassettes, magnetic tapes, CDs and microfilm.

14.1 INTRODUCTION

Material Repair is basically concerned with the remedial treatment of already damaged or affected materials. Library collections are affected by a number of factors, like quality and nature of the materials used in production, the library environment, the frequency of use and the treatment by users. Each of these factors helps in assessing the risk to the collections and anticipating the consequent repairs needed to be undertaken. In this unit we will mention some the methods which a librarian can adopt as a part of this regular activity. Material repair techniques are under constant review and revision. There is often, a lack of unanimity about the efficacy and safety of certain methods, and certain chemicals used.

A librarian should keep himself/ herself aware of the various developments taking place in this area.

14.2 BOOK REPAIR

Books and other paper-based materials are the major constituents of the library. Each library document is a physical entity, the basic materials and constituents of library materials being organic are susceptible to natural decay and deterioration. Documents are at risk from deterioration, damage, and loss not only because of adverse use, but also because of inherent instability and poor environmental conditions, handling, and storage. If the environmental condition is adverse, the process of decay and deterioration is accelerated. Any decision for material repair treatment can be taken depending upon various factors like:

- the physical characteristics of the material
- the economic merit of the in-house repair treatment
- the user demands that puts certain time constraints necessitating immediate in-house repair.

Repairs to valuable books are performed to avoid further damage to the material. Before undertaking any repair work the various resources (time, money, supplies and expertise etc.) needed to repair it should be taken into account. One can choose from a number of options that range from simple repair, expedient repair to full conservation treatment by an expert. Book repair procedures and techniques discussed in this unit are the ones that can be undertaken in-house, with a sound understanding of book repair. These techniques help in returning the high use materials to the stacks quickly after the treatment and are also more economical.

Training and workshops should be organized to acquaint the staff with simple book repair procedures which can be undertaken in-house with simple supplies. The various materials required for repair treatment must be stored separately in a conveniently located area. One staff member should be made responsible for taking adequate care that adequate amount of supplies is always available.

14.2.1 Book Repair Materials

The various materials used for book repair must be of archival quality and acid free. Archival quality products are lignin-free and buffered. Buffering neutralises acid content and helps in slowing down the future deterioration of an item. The materials must also be strong and durable. All these materials should be protected from light, dust, moisture, and insects, and kept separate from acidic materials. Some common materials required for simple book repair are:

1) Paper

Small pieces of paper are used for the repair of leaves and documents. (Paper is used for replacing the end papers in old books). Dover (size: 575 x 440 mm), hand-made paper yellow-cream in colour and Bodleian (700 x 500mm) white in colour, are examples of paper used for restoration. Besides these tissue is also used for book repair work.

Japanese Repair Tissue: Japanese repair tissue is a thin paper made from the fibers of the mulberry tree. This repair tissue is imported from Japan. This tissue has long fibers which make the paper very strong, even though it is very thin. Hand-made Japanese repair tissues have parallel chain or wire marks. These lines run in the same direction as

the paper grain. These marks are caused by the sieve or mould on which the paper is made. These lines are visible when the paper is held up to light.

Moreover, Japanese repair tissue is torn rather than cut. A piece of torn Japanese tissue has a delicate feathered edge that blends into the repaired paper. Japanese repair tissue is available in different weights and colours; one can buy the required colour to blend with the books to be repaired. Some recommended Japanese repair tissue types are:

- i) Tenjugo - 11gsm off white with fibrous texture, machine made. This is light weight and can be used for working over illustrations etc.
- ii) Kozushi - 20gsm grey-cream in colour, hand made paper. This is medium weight paper and can be used for most repairs.
- iii) Sekishu - This is a heavy weight paper which can be used for repair work of heavier paper.

Heat Set Tissue: This is a thin tissue, coated with heat activated, acrylic adhesive. Heat set tissue is sold with the silicone release paper. The tissue is torn or cut to fit the tear, then laid in position, covered with silicone release paper and then adhered to the paper (to be repaired with a heated iron). Heat set tissue does not have long strong fibers like the Japanese repair tissue and therefore, it tends to be more brittle. It should not be used in the folds in paper or areas that need to flex and bend.

Acid-free blotting paper: This is used to remove surplus liquid from treated paper.

2) Document Repair Tape

Document repair tape is a thin, acid-free paper tissue coated with pressure sensitive adhesive. The adhesive used is a neutral acrylic adhesive that does not dry up, yellow over time or seep out the edges of the document repair tape. This transparent, pressure sensitive mending tape is non-yellowing. It is removable with solvents such as methylated spirits. Document repair tape is available under different brand names like: Filmoplast P, Filmoplast P90 etc.

3) Boards

Best-quality millboard has a neutral pH and is used for replacing boards or for rebinding old books. Strawboard can be used for less valuable work.

4) Repair Adhesives

Two main kinds of adhesives used in book repair are paste and glue. Dampness degrades the adhesives making them susceptible to fungal growth, bacteria, insects and vermin. Synthetics which are resistant to heat, moisture, fungus, bacteria and insects have been developed but they have not supplanted pastes and glues for hand binding.

Paste: Paste is a cooked mixture of water and vegetable starch, such as wheat, rice, corn or potato. Paste is a powerful bond for paper and leather. It dries slowly and can usually be reversed with water. Paste deteriorates from bacteria, fungus and insects. Powdered paste ready to be mixed with water is also available.

Wheat Paste: Wheat paste is used to mend torn paper, attach Japanese tissue or soften old paste and glue. It is usually not used on book cloth or the case of the book. A small amount of paste can be made and kept in a refrigerator for a week. The recipe for this wheat flour paste is:

- 100g plain flour
- ½ litre cold water
- 2 drops thymol solution

Blend the flour and a little of the water in a double saucepan until smooth. Gradually, add the rest of the water. Heat it, stirring constantly until the mixture thickens. Remove from the heat and allow the mixture to cool and then add thymol. The paste can be thinned by adding water.

Glues: Various types of glues have been used in book binding. Some of them are:

i) Animal Glues: These glues are water-dispersant gelatins made from the hides, bones, hoofs and horns of cattle. It is used mainly because of its bonding strength. Flexible glue is used for spines where flexibility is an advantage. In recent years, animal-based glues have been replaced with synthetic vinyl resin glues, the most common of which is polyvinyl acetate emulsion.

ii) Polyvinyl Acetate (PVA) and polyvinyl alcohol: These are adhesive glues which can be thinned with water for different consistencies and effects. These are available under different brand names e.g., Spynflex, jade 403 from Talas etc., and not all are used for repairing books e.g. Elmer's glue is a PVA but is not flexible when dry and hence it has limited use for repairing books. The bond is not reversible and this is a disadvantage if used on old books. PVA has low moisture content and dries quickly. It is flexible when dry and the time taken for drying is conditioned by temperature, humidity and viscosity and therefore, can be used to tighten hinges, repair book cover corners and reattach loose book cloth to book board.

In book repair, too much adhesive should not be used, as it will ooze out of the edges of a repair and bond to the pages. Also too much adhesive causes the paper to wrinkle and takes longer to dry.

5) Linen Thread

Linen thread is used for sewing books. It is available in various sizes like 12/4, 18/3 25/3 etc. The first number is the thickness of the strand and the second number represents the number of strands or ply per thread. A thread which is too thick can damage a book and a thread which is too thin can tear through the folded signature paper. The right thread should be chosen depending upon the kind of paper and the number of signatures being sewn.

6) Cloth and Other Materials

Buckram and cotton cloths are used for rebacking, especially if the old spine is replaced.

7) Cloth Tape

Now even cloth tape is available which has a vinyl casting on high thread count cotton cloth. It is water proof, washable and has high tensile strength. It is available in various colours like blue, green, black, and white.

14.2.2 Book Repair Tools

The various tools and equipments used for book repair should be of good quality and appropriate for book repair. Some of the tools used for book repair are shown below:

Folder: This is a tool which can be used for easing paper, smoothing repair tissues and working cloth into joint area. It is approximately 6-8" long and 1-1½" wide, 1/8" thick, smooth with one pointed end and one rounded end made from animal bone or plastic.



Fig. 14.1: Bone Folders

Microspatula: This tool is used for picking up pasted strips of Japanese repair tissue, lifting book cloth or end papers away from the book, or applying glue or paste in a very tight area. It is a metal tool about 6-8" long with one rounded end and one pointed end.

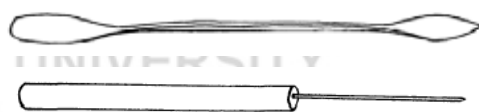


Fig. 14.2: Microspatula and Piercer

Piercer: A piercer is used to apply glue to small, tight areas, mark cutting lines or score tear lines on Japanese repair tissue.

Brushes: Brushes of different size (thin, medium, thick), round or flat bristle ones, can be used, depending upon the surface to be pasted or glued. Natural bristle brushes are good for repair work, synthetic bristle brushes can also be used. Brush should be cleaned of the adhesives after use.

In addition to these, scalpel, scissors, knife, knitting needles of different sizes, sewing needles, cutting boards, rulers, plastic erasers, surgical gloves are some other equipments which are required for carrying out book repair work.

Self Check Exercise

- 1) Write a note on glues which are used in book repair.

Note: i) Write your answer in the space given below.

- ii) Check your answer with the answers given at the end of this Unit.

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14.3 BOOK REPAIR PROCEDURES

A certain percentage of collections in a library wear out each year, however, in-house book repair should not be seen as a solution to book damage. The main focus should be

on the minimisation of the damage itself. The various causes that generate damage and deterioration of the library materials should be examined and proper steps should be taken to control or eliminate them. In addition to this, increasing staff and user awareness on proper handling of books and other materials will also reduce the amount of damaged books/materials in the library.

Some factors should be always kept in mind before undertaking any book repair work:

- Any treatment applied to a book should be reversible, that is it should be possible to undo it at a later date.
- Any repair work that seems difficult and out of your skill or expertise should not be undertaken.
- Any simple book repair treatment undertaken in-house should not take hours or days of staff time.

Now, let us go through simple book repair procedures, that is, those repairs that can most easily be completed in-house by the library staff with a sound understanding of book repair.

1) Book Cleaning

Before cleaning, the book should be carefully scrutinised and the least abrasive cleaning method should be used first.

Dry cleaning is a cleaning procedure where any kind of water or liquid cleaner is not used. Some of the tools that can be used are dry cleaning pad, soft brush, erasers, paper towels etc. Brushes used for dry cleaning can be of any size but should have soft, natural bristles, as plastic or nylon bristles can scratch the paper. Some dirt can be removed from the page using a soft, natural bristle brush. The pages should always be brushed from the center of the page out towards the edges in a star burst pattern and up-down the hinge area to remove dirt or eraser crumbs. Never brush from the edge of the paper towards the middle and take care of the paper tears that can be caught in the brush. Erase pencil marks, if any, using a white vinyl eraser. Erase in one direction from the center to the edges of the paper. Then remove the eraser crumbs with the help of a brush.

Grease like marks in the book, if any, can be absorbed by inter leaving the book with paper towels and then closing it. If this does not work, sprinkle the contents of the dry cleaning pad (e.g. Opaline, Skum-X) on the marks. Using clean fingers rub the paper lightly in a circular pattern and then brush away, after a while.

2) Hinge Repair

Now-a-days books consist of a text block. While constructing a text block, first the pages are attached to one another, then the spine is covered with a cloth liner called crash, and a paper spine liner is added over that.

The book case consists of a front cover, a spine and a book cover, and is constructed separately. Then the text block and the book case are attached by gluing the crash and end papers to the case cover. The text block is held into the case with the help of crash which is covered up by the end papers. This crash cloth that covers the spine of the text block and is glued to the cover boards is the major point of attachment between the text block and the cover. With time the adhesive in the hinge area dries up, the crash separates from the book board and hinge area becomes loose. The end paper also splits along the hinge making the crash visible underneath.

Before undertaking repair of the hinge, inspect the hinge carefully. If the text block is loose in its case with the endpaper still attached to it a simple repair treatment can be used. Materials required are polyvinyl acetate adhesive (PVA), knitting needles or thin bamboo sticks, waxed paper and a bone folder.

In order to repair, stand the book on its tail and open the loose hinge with one hand. Take one knitting needle dipped in adhesive, and insert it into the hinge as far as possible, using a twirling motion (fig. 14.3). Apply the adhesive thoroughly. Turn the book on its head and repeat the same procedure on this end. Lay the book flat on a table. Put the text block squarely in its case and press the book cloth into the case joint using the long thin edge of a bone folder on the outside of the cover. This will adhere the crash, end paper and book board. Now open the book cover and gently press the endpaper into the hinge with a bone folder. Then insert a sheet of waxed paper as far as possible back into the hinge. This will protect the endpaper from excess adhesive and assure proper opening of the book after drying.

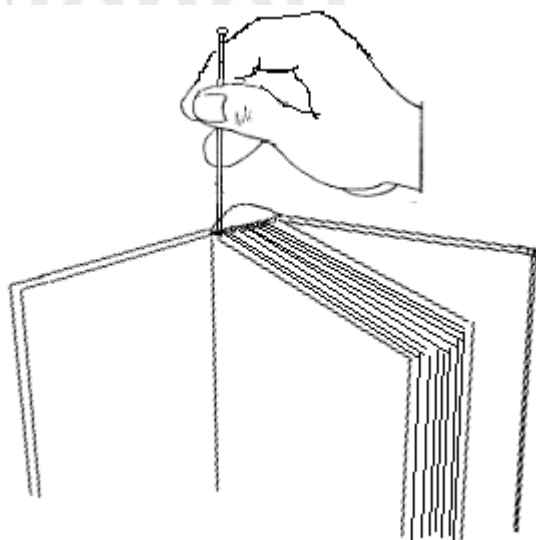


Fig. 14.3: Applying Adhesive with a Knitting needle

Leave the book to dry for several hours or overnight, in a book press. Otherwise you may use needles and boards to press the book. Put knitting needles or shelf-list drawer rods in the hinge erases of the case, sandwich the book between the boards and place weight on it (Fig. 14.4).

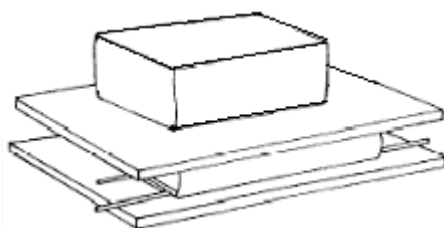


Fig. 14.4: Book with weight on it

If the endpaper is split at the hinge, and is pulling away from the inside of case showing the spine hinging, another treatment can be used for repair. If more than 1/4 of the crash is torn, it should be replaced. The materials required are polyvinyl acetate adhesive (PVA), small point brush or microspatula, wax paper, and bone folder.

Open the book to the place where the end papers have split from the text block. Lay a piece of scrap paper along the text block about 1/8 inch from the exposed hinge area. Apply adhesive with the help of a brush or microspatula and work the endpapers into position. With the book still open, align the end paper and the text block carefully. Using the edge of the bone folder, gently press the fold of the endpaper into the hinge. Insert a piece of wax paper into the hinge to prevent excess adhesive from sticking to the endpaper.

Close the block and make sure that the text block is squarely in its case. Then run the long edge of a bone folder on the outer hinge of the case applying even pressure. Then press the book for several hours or over night using any of the methods discussed earlier.

3) Tipping in Loose Pages

Tipping-in is a method for inserting loose pages in a bound volume. Materials required are polyvinyl acetate adhesive (PVA), strips of scrap paper, waxed paper, a bone folder, a glue brush, a pressing board or glass plate, and a weight.

If the page to be dipped in is larger than the pages of the volume, carefully trim the page to size using a paper cutter. Place the page between two sheets of scrap paper, leaving 1/8-inch of the inner margin (along the binding edge of the paper) visible. Apply a thin, even layer of adhesive along this exposed margin. Remove the scrap paper. Carefully insert the page into the book ensuring that the edges are even with the rest of the text block. Slide the tip of a bone folder along the unglued side of the sheet to press it tight. Place wax paper sheet on either side of the tipped-in page to protect the pages from excess glue.

Put the repaired book under a glass plate or pressing board along the spine edge with weight over it. Let it dry overnight. When the repair is dry, remove the wax paper carefully and make sure that the page is securely attached.

4) Hinging-in Detached Pages

Hinging-in is commonly used when the text block is **sown** and the pages open flat. A detached page can be hinged to the page in front or in back of it. However, it is advisable to hinge from the back of the detached page to the front of the page immediately behind it. This will make the Japanese repair tissue support the page underneath as it is turned.

Tear a strip of the Japanese paper approximately 1/2 inch wide and a bit longer than the page to be tipped-in. Place the page to be hinged on a sheet of wax paper. Place another sheet of wax paper on the page leaving a visible inner margin of 1/8 inch. Apply adhesive on this exposed margin and then remove the wax paper on top.

Carefully place the Japanese tissue strip on this glued inner margin of the page to be hinged. The tissue strip should be so placed on the page that half of it hangs out of the page. Use a folder to gently rub or smooth the repair tissue and thus secure the attachment. Cover this glued repair work with wax paper and let it dry under a flat board or light weight. When the first half of the repair is dry, trim the top and bottom edges of the Japanese tissue using a scissor or scalpel (Fig. 14.5).

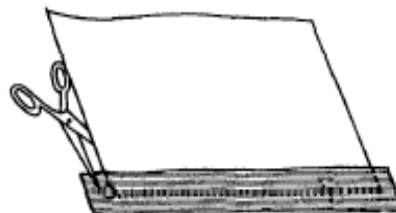


Fig. 14.5: Trimming the top and bottom edges of Japanese tissue

Source : <http://www.library.state.ak.us/hist/conman.html>

Place the wax paper and waste paper in the folded hinge. Carefully apply adhesive on the exposed edge. Remove the waste paper and position the hinged page into the book. Using a bone folder rub the hinge and adhere it to the inner hinge. Place wax paper on the either side of the hinged page to protect adjacent pages from moisture and oozing glue.

If the edges of the hinged-in page are not even with the rest of the text block, trim it with an X-facto knife and ruler. For this, place a thin cardboard under the page to be trimmed and slip a flat metal ruler between the page to be trimmed and the page before it. Place the ruler in-line with the edge of the page before it and trim the excess margin from the page beneath the ruler.

For hinging in multiple pages several options can be used. One option is that the loose pages can be hinged to one another as a unit and then hinged into the text block or each page can be hinged into the text block one at a time.

5) Spine Repair

Improper handling and shelving techniques lead to the wearing out of the spine of the book. Books with loose damaged spines can be repaired by replacing the original book cloth spine. For this first the original spine should be removed. With the help of a scalpel and straight edge ruler remove the original spine by slicing through the book cover cloth from both the front and back covers. If the original spine is in good condition and can be re-used, save it.

Remove the spine from the book and peel the paper spine away from the cloth spine. You can also use a knife to cut through the cover cloth but be careful not to cut through the crash or the end paper. Examine the paper spine liner attached to the text block. For this open the text block to the center of the book and see whether the spine arches in the form of a gentle curve or a sharp “V” (as shown in Fig. 14.6). Sharp “V” indicates that all the stress of opening the book is concentrated in one place. A gentle curve evens out the stress of opening the book. A “V” curve can be evened out by attaching a paper liner.

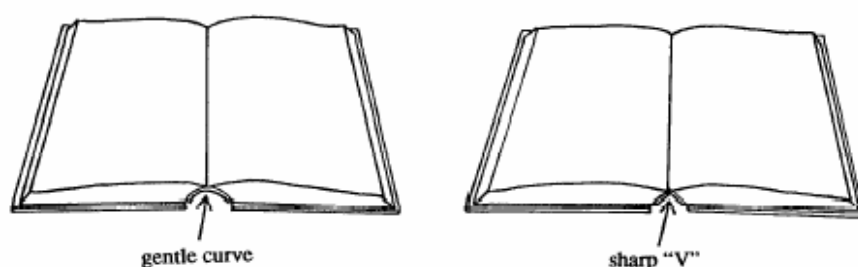


Fig. 14.6: Spine Curve

(Source : <http://www.library.state.ak.us/hist/conman.html>)

Take two strips of paper and mark the thickness of the block on one strip and height on the other.

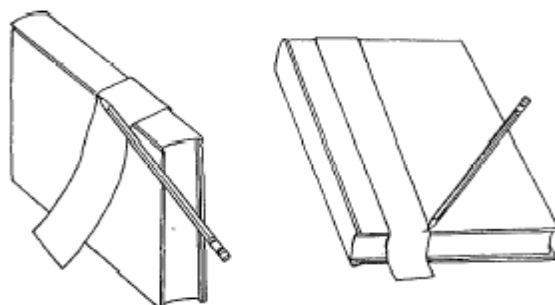


Fig. 14.7: Marking thickness and height on strips of paper

(Source : <http://www.library.state.ak.us/hist/conman.html>)

Using these measurements cut a strip of spine liner paper. The grain of the spine liner should run parallel to the spine of the book. Apply adhesive to the spine liner by brushing from the center towards the outer edges. Attach the paper spine liner to the text block by rubbing with a bone folder.

Take a strip of book cloth and mark the width and height of the spine on the book cloth. Now, cut the book cloth strip leaving 2 inches extra on all sides. The grain of the book cloth should run parallel to the spine of the book. Fold the top and bottom ends of the book cloth and make a crease. Make V-slit cuts at each end (top and bottom) corresponding to the width of the spine liner. Apply glue to the centre section at the top and bottom of the spine cloth and fold it smoothening/rubbing it with a bone folder (Fig. 14.8). Place the spine cloth in sheet of wax paper and under some weight to dry.

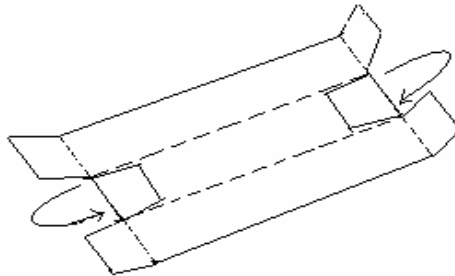


Fig. 14.8 Preparing the Spine Liner

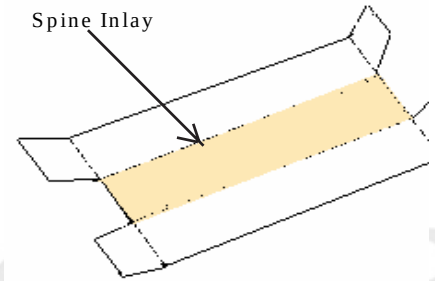


Fig. 14.9 Adhering Spine Inlay to the Spine Liner

Now prepare a spine inlay to line and stiffen the book cloth spine. For this cut a piece of acid-free paper. The grain of the paper should run in the same direction as the spine of the text block. The spine inlay should be of the same measurement as the spine. Apply glue to it and glue it to the centre of the new spine cloth as shown in Fig. 14.9. Now, we have to attach the spine cloth on the text block spine. Using a microspatula gently lift the book cloth on the cover. Applying glue on the cover attach the new spine cloth onto the book with a folder to create a new spine. Insert rods into the joint and let it dry for a few minutes. Apply adhesive to the lifted book cloth and press it rubbing with a folder. Mount the original spine on the new spine. Put rods in the joints and let the book dry under weight.

6) Corner Repair

Generally it happens that the corner of a hard cover book gets damaged while the rest of the case is in reasonably good condition. With use, the corners of the cloth-bound books become rounded and broken, and the fabric is also worn out. These corners can be repaired.

In some cases the corners are damaged but the book cloth is intact. To repair such a damaged corner, cut through the book cloth from the top and lift the endpapers beyond the damage with a knife. Separate the layers of the board, and apply adhesive to these book board layers with a microspatula or knife. If the book cloth is in good condition then apply glue on the inner side of the book cloth and smooth it over the corner with the help of a folder.

If a corner is completely damaged, cut through the book cloth along the top and bottom side of the book board to fully expose the ragged edge of the book board. Remove the book cloth and diagonally cut the ragged edge of the damaged corner. Trim only as much board as necessary. Make a second diagonal cut, about 3/8-1/2 inch inside the first cut. With a knife or microspatula cut through half the thickness of the book board. A piece of book board of similar thickness is cut in the same fashion to create a reverse step that will fit into the step cut into the book cover. Fit this replacement corner into the book. Apply glue to fix it. Dry the repair under weight.

If the book cloth is also damaged and worn out a new book cloth should be attached to the repaired corner. For this cut a triangular piece of new book cloth. Glue this book cloth

patch on the outside of the book cover leaving 1-2 inches of the new book cloth on each side of the corner. Take care that the grain of the book cloth runs parallel to the spine of the book. Dry it under weight. Fold the tip of the new book cloth corner over the book board towards the inside in such a way that it touches the book board tip. Press it to form a crease. Unfold and cut the new book cloth along this creased line. The new book cloth now has two edges – top (i.e. the top or bottom edge of the book) and the fore edge (the other edge).

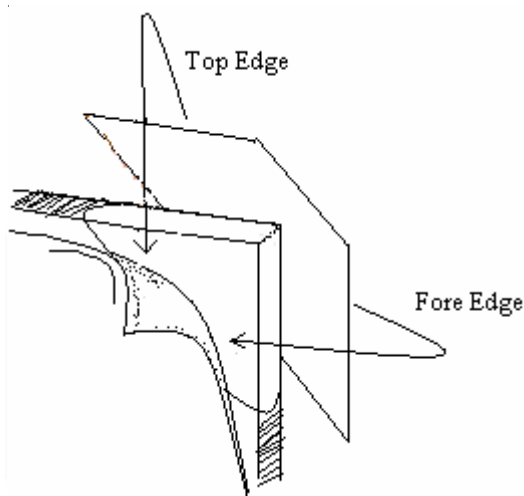


Fig. 14.10 Repairing a Corner

Apply adhesive (i.e. PVA) along the top edge of the new book cloth and fold the edge over the book board (Fig. 14.10). Press the book cloth against the thickness of the book board with a folder. Similarly, apply glue to the fore edge of the new book cloth and put it in position over book board with a folder. Trim the original cloth to eliminate the ragged edges. Loose fibres can be glued to some what camouflage the repair work. Allow the repair work to dry for some hours, under weight.

Missing corners, worn and fragile margins of pages can also be strengthened with Japanese tissue. For this, place the damaged page/leaf on wax paper. Take a strip of Japanese repair tissue and fold it in half and place it over the missing corner. The repair paper should be slightly larger in area than the missing portion. Needle or water tear the two layers of repair tissue. Apply paste to the repair patch and adhere it to one side of the missing corner. Fold the patch and press the edges of the patch into the page. Use a folder to firm the repair place it between wax paper sheets and allow it to dry under weight.

7) Mending Torn Pages

A simple paper tear can be repaired with wheat paste alone. Apply wheat paste, with the help of a fine brush or microspatula, to the top and bottom edges of the tears. Press both edges together. Cover the repair with wax paper and press the edges of the tear with a folder wipe away any excess paste and allow it to dry.

Japanese tissue is also used to reinforce and mend tear. For this take a strip of the Japanese tissue. In order to provide maximum concealment the strips should be torn rather than cut with scissors. A piercer can be used to tear a Japanese repair tissue. The point of the needle creates a “dotted line” on the surface of the repair tissue to tear along. Or take a small brush wetted with water and draw line where the tear is to be made. The water will weaken the tissue allowing it to be pulled apart, leaving the edges feathered.

The strip of tissue should be slightly longer than the tear. Apply paste on the tissue with a needle or microspatula and picking up one end of the tissue with the tip of the spatula carefully place it on the tear. Using the spatula and working from the tear to the edges of

the tissue, gently apply the tissue to the item being repaired, blending the tissue fibers into those of the document. If any tissue protrudes/extends beyond the edge of the paper, fold it over to the backside of the page thus giving reinforcement to the tear at the edge. Cover it with wax paper and press it between chip board or blotter paper using some weight. If anything goes wrong the tissue and paste can be easily removed with water. Long or irregular tears should be treated with several small over-lapping strips of Japanese tissue.

Paper cuts can also be repaired with the Japanese repair tissue patch. Repair tissue should be put on both sides of the cut to reinforce the repair.

Self Check Exercise

- 2) Mention the various steps involved in the repair of a hinge with the endpaper still attached to the text block.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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14.4 CLEANING AND SOME OTHER TREATMENT TECHNIQUES

Cleaning

Dry cleaning helps in removing surface dirt. If dry cleaning is unsuccessful wet cleaning can be carried out. But this is a time consuming and costly process. Wet cleaning involves taking the book apart and washing each page. Papers should also be strong enough to withstand immersion in liquids for some hours.

Slightly soiled paper can be washed by placing in a bath of tepid water for about half an hour. The surface of the paper should be brushed with a soft-haired brush and the water should be changed frequently. The sheet should be removed from the bath. Absorb the excess liquid with blotting paper and resize. If the paper is ingrained with dirt it should be washed by immersing in two liters of warm water and a teaspoon of detergent.

Stain Removal

Books and documents sometimes get stained because of various reasons. There are various methods of removal of such stains and often organic solvents are used as cleaning agents to dispose of matter insoluble in water. Some of the solvents/chemicals used for cleaning are shown in Table 14.1. However, these solvents should be used judiciously as these chemicals could lead to defacement and degradation of paper. The stain should be properly scrutinized and an appropriate solvent should then be selected accordingly. Misuse of a cleaning agent is also risky for a document. These solvents are highly toxic, flammable and

therefore, should be used with extreme caution. The point which requires serious attention is that if the stain is harmless, it is better to leave it alone. Any attempt to remove stains, which invariably requires the use of chemicals, may damage the media, reduce its longevity, and cause fading of the image and other irreversible injuries to the artefact. Moreover, stain removal should not be attempted without expert guidance.

Water soaking results in a reddish-brown irregular line at the perimeter of the moisture. This water stain can be removed by soaking the sheet in lukewarm water and then resizing it. Minor stains, for example ballpoint ink, can be reduced by exposure to air and sunlight.

Ink stains can be removed by washing in a solution of citric acid in water, for an hour. Then resize the paper. Stubborn ink stains can be treated with sodium formaldehyde sulphonylate. Dampen the stain in water and then sprinkle with the chemical powder. Then wash the sheet in water for an hour and resize.

Tea and coffee stains can be removed by applying with a fine brush, 2 percent solution of potassium perborate in water. The excess liquid with a blotting paper and then apply water with a brush to remove the solution.

Table 14.1: Stains and Chemicals Used for their Removal

	Nature of Stain	Some of the chemicals used
i)	Stain caused by foxing, water, and fingers	20g chlorine T per litre of distilled water for better result: Calcium hypochlorite
ii)	Grease, tat, and fatty substances	Carbon tetrachloride
iii)	Oil and wax	Hexane and Toluene
iv)	Insert stain	Hydrogen peroxide mixed with an equal volume of alcohol
v)	Tea and Coffee	2% solution of potassium perborate in water
vi)	Ink stain	Citric acid in Water

Insect stains that deface paper can be eradicated by touching the spots with a fine brush clipped in hydrogen peroxide mixed with an equal volume of alcohol. Remove excess liquid with a blotting paper. Then paint with water to dispose off the peroxide.

Mould infected sheets can be treated with 20gm thymol in one litre of industrial methylated spirit. Leave the sheets in solution for 15 minutes, then wash for an hour and resize. Small areas of mould infections can be treated by dabbing with a cotton wool pad soaked in the above mentioned solution. Then remove the solution by applying water and then absorbing it with a blotting paper 3-4 times.

The term Foxing is used to refer to stains which are either dark reddish-brown with wavy or irregular edges. Foxing is most prevalent in books, published in the nineteenth century, with a higher percentage of lignin. Higher lignin content makes paper vulnerable to discolouration. The brown marks affect the value and longevity of the book. The paper becomes thinner at the brown areas and absorbs moisture rapidly at those very places. This encourages growth of fungus and other micro-organisms. Presence of slight traces of metals in these marks leads to the formation of stains e.g. copper and zinc produce dark brown stains and iron produces yellowish stain. Bleaching can be used to remove these marks but foxing may reappear after some years. Fumigation and treatment with a non-aqueous deacidificant can also be used to remove moulds and stop deterioration.

Bleaching

Bleaching is a process which could be used to remove grime and discolouration from foxing, fungus etc., and whiten paper. Bleaching may be undertaken by exposure to artificial light, sunlight or it can be done with chemicals. Bleaching with chemicals is harmful for the paper and fibres. Bleaching with lights is often preferred by conservators because it is gentle and not harmful to cellulose.

Chemical bleaching of paper must be done under carefully controlled conditions. It involves immersion in chemical solutions and then washing in water. Indiscriminate use of acid and alkali cause ink and colour to fade, and degrade the quality of paper. Therefore, bleaching should be as minimal as possible. If the stains are harmless they should be allowed to remain and bleaching should be avoided. Minor stains like ballpoint ink, can be reduced by exposure to air and sunlight. However, foxing and other dark stains require chemicals for their removal. 1-5gm. per litre of calcium hypochlorite is a recommended solution, as effective bleach for foxing, water and fungus stains. Paper is soaked for four hours in a bath of water changed in frequent intervals. The chemical should be applied to the area of stain only, for this the paper should be immersed in a bath and then the solution maybe brushed or sprayed on. The treated area should be rinsed in water thoroughly in order to remove the bleach. 20gm. of chloramine T per litre of distilled water is slow acting bleach.

De-acidification (or alkalisation)

Simple washing in water, is often enough to reduce acidity, however, addition of an alkaline buffer is sometimes recommended. This can be used for paper prone to acid attack even after washing or for acidic papers that cannot be washed. The presence of acid in paper can be tested with a pH meter. Brown Cresol Green ink may also be used to test pH of paper. For this paper is touched with this green indicator ink. A blue colour indicates alkalinity, yellow colour indicates acidity and green indicates that it is neutral.

Acidification can be achieved by an aqueous method, in which paper is immersed in 0.12 percent solution of calcium bicarbonate for half an hour. Then the excess liquid is removed with a blotting paper, and the paper is allowed to dry. This helps in neutralising the acid content and leaves an alkaline residue as a buffer to further contamination. A solution of 10gm per litre magnesium bicarbonate can be sprayed but the paper should not be excessively moistened.

For de-acidification, paper can also be treated with a non-aqueous solution consisting of an alkaline salt dissolved in organic solvents. e.g., a solution of methyl magnesium carbonate in a solvent. Such a solution is generally applied by spraying. It dries rapidly and has no effect on paper. De-acidification is, however, not recommended for all materials. Such chemicals may often cause alteration or even damage to pictures, illustrations etc. Some colours may change if subjected to alkaline conditions. Therefore, de-acidification must be carried out selectively and carefully.

Retouching

This involves judicious application of water colour, acrylic or pastel to minor surface losses such as scratches, small abrasions, or media losses along tears. Colour tests must be made in order to match the original. Care should be taken and retouching should be confined only to the area of loss. Waterproof inks, emulsion poster colours etc. could be used for retouching purpose. However, coloured felt-tipped and ball point pens should be avoided as their colours are unstable.

Filling/repairing worm holes

Insects often bore holes in the leaves of books and documents. To repair such damage worm holes should be filled with a mixture of paper scrapings and paste. For this select a

similar paper scrap off some fibres and mix them with a non-staining paste to a stiff consistency. Place the leaf on wax paper on a hard surface. Take small amount of this mixture on a blunt scalpel or spatula and fill it into the hole. If the damage is extensive the Japanese repair tissue can be pasted on both sides, covering the damaged area. In case of leather covers, the holes can be filled with a mixture of leather scrapings and paste.

Removal of Mold and Insect Residues

Mold and insect deposits can be eliminated by the use of mechanical means. Small vacuum aspirator can be used for lifting mold. At times fungus may be well rooted in the paper and some traces of mold may be left under this treatment. Fumigation and fungicides may be used in such cases. However, fumigation is now seldom done because chemical fumigants affect inks, colour, text and illustrations, etc. adversely. They are also harmful for the personnel carrying out the treatment process.

Lamination

Lamination is done to strengthen fragile documents by sandwiching them between layers of transparent paper or acetate tissues. The laminate selected should be strong enough to resist handling. After lamination the information/text should be legible. Papers of less than 6 pH should be de-acidified before lamination otherwise decay will continue. The lamination process should be reversible.

14.5 FLATTENING FOLDED OR ROLLED PAPER DOCUMENTS

Paper materials become fragile with time due to various factors like inherent weaknesses, temperature variations, humidity, light etc. Rolled or folded paper documents should be flattened carefully, lest they crumble leading to the permanent loss of valuable information. Humidification helps to safely flatten certain paper documents such as maps, newspapers etc. which have been rolled or folded for long periods of time. The process of Humidification involves careful introduction of moisture into paper and then drying it under controlled conditions. It consists of three basic steps: cleaning, humidifying, and flattening.

Cleaning - The paper document should be first cleaned of any dust/dirt on its surface with the help of a soft, natural fiber brush. If not removed, the dirt becomes ingrained into the paper fibres, during humidification. Any fasteners such as clips, staples, rubber bands etc. should also be removed before humidifying.

Humidifying - The process of humidification is carried out in a simple chamber (humidifier) that can be constructed easily, depending upon the number and size of the documents to be flattened. Humidification can be done using hot water vapour or cool mist of an ultrasonic humidifier.

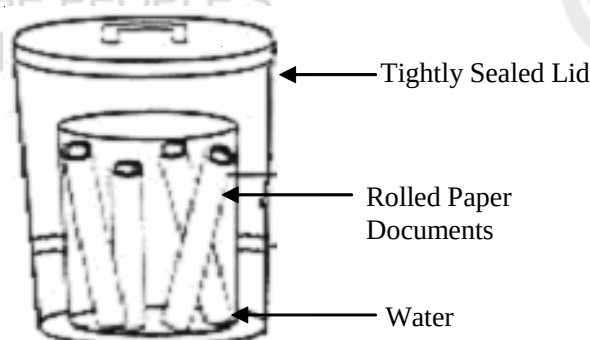


Fig. 14.11 Humidification
(Source: Alper (1993))

The basic requirement is a water tight container inside an air tight container. The purpose is to make the documents absorb moisture without coming in direct contact with water. Take a small plastic and place the documents to be flattened in it. Then, take a large plastic trash can filled with about 3-4 inches of water and 43°C – 60°C. Place the small container into this large container. Care should be taken that the water never comes in direct contact with the paper to be humidified.

Flattening – This is the final step in the humidifying process and involves drying and flattening. When the papers become damp, they should be removed from the container carefully. A sheet of blotting paper should be placed on a flat smooth drying surface like table. Then place the documents on it, unrolling them with the curl towards the table and cover with a layer of blotting paper. Then cover this “sandwich” with a glass sheet or smooth, fairly heavy sheet of board and let dry. The weight should be fairly heavy in

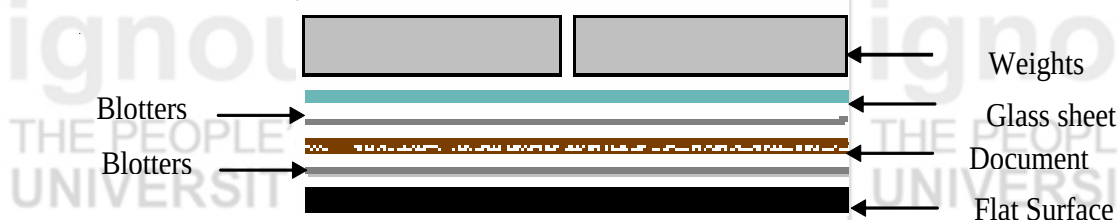


Fig. 14.12 Flattening

order to prevent cockling. The entire process can take from 1-24 hours. And if the papers are not flattened after treatment the process can be repeated.

The humidifying treatment should be used with discretion. Paper documents with water soluble media like water colour and water soluble inks; and other media like chalk, charcoal, oil paint etc. should never be humidified. Parchment or vellum should also not be humidified. Photographs can also be relaxed and flattened using this process. However, nothing should be placed on the emulsion surface during drying. After removal from the humidifying container the photograph should be placed on a blotter with weight only on its (photograph) borders and it should be left to dry.

14.6 REPAIRING AUDIO/VIDEO CASSETTES

Video and audio cassettes wear out with time and usage. They could be wrinkled or warped while playing. Before taking up any restoration work one should first determine if the tape is worth repairing. One of the problems with audio cassettes could be – a reel that does not turn. For this examine the cassette and see if the tape is snarled and jamming the reel. To fix the problem you'll have to open the cassette. Audio cassettes are made up of two half shells. The two half shells may be held together with screws or they may be just glued together. Open the shell carefully. To open a glued shell, take a small knife and find a spot in the case along the seam that can be penetrated with a knife, open it by working the knife forward. Examine the reel pack. If it is bumpy and unevenly packed, free it up by rapping it flat against a table top, first on one side, then the other. When it starts turning freely, stick it in a player and wind it to the end, then again till the beginning, to repack it.



Fig. 14.13: Audio Cassette

If the tape is badly wrinkled but not torn it should be left as it is. It will still play although the sound may be a bit muffled. If the tape is torn or stretched badly and will not play it should be edited and spliced. Trim the broken tape ends in order to make a neat splice. Bring the two ends close together (they should not overlap) and apply the splicing tape over the two ends on the back side of the tape, so that it will face away from the heads in the machine. Remove excess splicing tape if any, with the help of scissors while holding the tape with tweezers. The splicing should be done using a professional audio/ video tape splicing kit. As in any other tape the adhesive will melt and ruin the player.

One other problem usually encountered is “half twist” i.e., when played the voices appear muffled and the tape playing backwards. Such a tape must be pulled out and rewound by hand till the second twist. In case of a full twist, i.e., if the tape has jumped over one of the reels, the tape case should be opened and the tape flipped over, to restore it.



Fig. 14.14: Video Cassettes

In case of a video tape if the plastic cassette is broken and the video tape inside is still in a good condition the tape can be transferred into a new housing. If the tape is broken it can be repaired by splicing. It is always better to replace rather than repair a tape. However, if an audio/video cassette is repaired it should be run through the player only once and copied to another cassette.

14.7 REPAIR OF MAGNETIC TAPE

Magnetic tape consists of two-or-more layers of materials. The top layer consists of a magnetizable particles suspended within a polymer binder, which is composed of polymers such as cellulose nitrate, acrylic resins etc. This binder holds the magnetic particles together and to the tape backing. The binder holds the magnetic particles together and to the tape backing. A lubricant may also be added to the binder to reduce friction, or a head cleaning agent may be added to reduce the occurrence of head clogs. Failure of a magnetic tape may occur due to problem in any one or all the three components of a magnetic tape i.e., magnetic particle, binder, and backing. Some of the physical deformation problems associated with tapes are:

Popped Strands: In this case one to several strands or wraps of tape protrudes from the edge of a round roll of tape. This mostly occurs when the pack is wound improperly.

Cinching: This is the wrinkling or folding over of tape on itself, usually when a loose tape pack is stopped suddenly. It can lead to further creasing of the tape and then to peeling or shedding tape.

Vinegar Syndrome: This appears in the tapes of 1940s and 1950s when acetate (like cellular acetate) was used as a backing material. This substrate is susceptible to hydrolysis. As a result of degradation a faint odour of vinegar is emitted from the tapes. In the advanced stages of degradation, the magnetic tapes become brittle and break easily if bent sharply. Tapes having vinegar syndrome should be stored separately. After the onset of the problem, degradation occurs at an accelerated rate, therefore, any valuable tape should be transcribed at the onset only.

Pack slip: This occurs when the pack is wound improperly. It causes the tape to unwind unevenly, and also to play at an uneven speed. It can cause edge damage when the tape is played. It occurs in the form of high or low spots in a smooth tape pack because of the lateral movement of sections of the tape roll.

Breaking: This deformation results from bad handling and leads to the separation of a piece of tape into two or more parts.

Flange pack: This occurs when the tape roll gets wound up against one or the other sides of the tape reel. Flange pack is generally caused by malfunctioning equipment or loose wind.

Creasing: This is the folding of sections of tape such that it is ridged or wrinkled. This is caused by cinching or mishandling of tape.

Blocking: At times factors like deterioration of the binder, storage at high temperature etc. lead to sticking together of two or more winds in a tape pack. This is known as blocking.

Sticky tape and Sticky Shed: These are the two phenomena associated with the deterioration of the magnetic tape finder. In sticky tape phenomenon one or more parts of a tape may adhere to other surfaces. It is generally caused by breakdown of the binder or the back coating and is characterised by softer than normal binder coating, higher friction and gummy tape surface residues. It results in blocking, oxide loss, heat clogs, sticking and slipping of the tape as it moves across the heads and squealing of audio tapes. Sticky shed occurs when the deposits (i.e., oxide etc.) from magnetic tape rub or wear off onto the various parts of the equipment, when a sticky tape is played. Sticky shed also causes mistracking, blocking, head clogs and alternate sticking and slipping of the tape as it goes across the heads.

Lubricant Loss: Lubricants are added to the binder to reduce the friction in the movement of the tape through the recorder and reduce tape wear. Lubricant loss is an inevitable part of the aging of magnetic tapes. Lubricants are partially consumed every time the tape is played (Bogart, 1995) and degrade with time depending on the storage and use condition. Lubricant loss leads to increased friction of the tape, sticky-tape, head clog etc. In specific instances this can be corrected by re-lubrication of the tapes, but this must be done carefully by experienced individuals. Lubricants such as silicone solution may be applied judiciously with a wicking or cotton ball applicator.

Oxide loss: This may result from poor binder adhesion, unnecessary friction and scratching of the tape. It involves the separation of the oxide from the base and is not easily correctible.

Demagnetisation: The recorded information is stored magnetically in a magnetic tape with the help of magnetic particles. Any change in the magnetic properties of the tape could lead to irretrievable loss of recorded information. Demagnetization of a tape can result from an externally applied field, such as that produced by a hand held metal detector at an airport security check point. However, demagnetisation is not common and can be avoided by proper storage and handling.

Cleaning, rewinding and splicing of tape

If required a tape should be cleaned very gently. It should be cleaned with soft, lint-free cloth, and moisture and chemicals should be used sparingly.

- Clean the outer surface of the tape pack for this you may use a tape winder/cleaner at a slow speed.
- If the tape is contaminated with organic debris, immerse the tape in tap water, rinse in a mild (10%) HCl solution, rinse in tap water, rinse in distilled water, air dry.
- If a tape becomes moldy copy it, transcribe it, and then clean the copier.

Physically deformed tape can be repaired by careful rewinding. However, it should be done under expert guidance. Rewinding is helpful in case of warped, wrinkled, creased pack-slip, cinching, or flange packed tape. In case of sticky-shed syndrome tape should be baked before being rewound. Splicing can be used to mend broken or cut tapes. However, the tapes specifically made for splicing should be used for this purpose and the splice should be as neat as possible.

Tape Baking: This procedure can be used to temporarily improve binder degradation, allowing sticky tapes to be played. The Ampex Recording Media Corporation has reported that treating a sticky tape at 45°C to 55°C for 36 hrs will sufficiently firm up the binder coating so that the tape can be played. However, the effect of the treatment is temporary and the tape should be copied within one or two weeks. The tape should not be rewound before baking.

Self Check Exercise

- 3) Write a brief note on sticky tape and sticky shed syndrome associated with magnetic tapes.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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14.5 REPAIR OF OPTICAL DISKS

Compact discs are durable and convenient to use however, they can be damaged through use and abuse. A CD consists of a simple piece of clear polycarbonate plastic, about 1.2 mm thick. CD's consist of different layers. Let us see the structure of a CD.

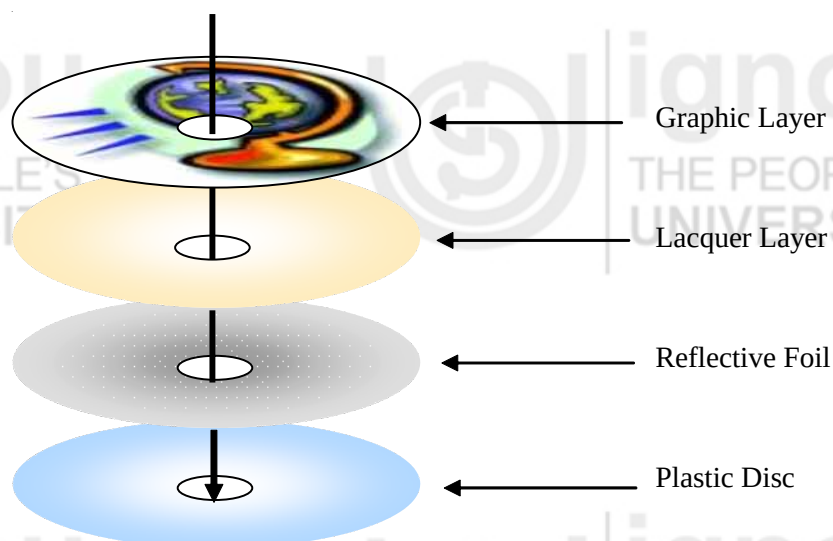


Fig. 14.15: Structure of a CD
(Source: <http://www.cdrepairman.com/>)

First layer is the Polycarbonate Plastic Disc. On top of this plastic disc data is stamped in the form of zeros and ones. Second layer is the Reflective Foil. This consists of a micro thin layer of aluminium (copper, silver or gold on a high quality CD) covering the data. This layer reflects light back through the plastic disc, allowing the stamped data to be read. Third layer is the Lacquer Layer which forms a thin layer of sealant for the foil layer. This seals in the foil layer, but offers little or no protection for the foil or the data beneath. Then is the graphic/label Layer which consists of a label printed onto the lacquer layer for graphic and sales impact. Recordable CDs don't have this layer. The reflective foil, lacquer, and graphic layers combined are as thin as a human hair and offer little to no protection of the data beneath them. There are slight differences between the repair of a CD disc and a DVD. In a DVD, the thin foil layer is around the middle and the lacquer layer is missing. In case of a music CD or game, this data layer is closer to the label side of the disk. This means that a CD can be fixed more often, and a CD scratch that is far deeper can be repaired than a scratch on a DVD. In short, CDs are very easily salvageable.

Scratches are one of the worst enemies of data on an optical disc. When the laser in the player hits a scratch, the refraction causes the laser to mistrack and it is unable to find the next digital "one or zero" on the bit plane (magnified digital wafer shown to right). On a music CD one hears the repeating glitch sound as the laser is stuck looking for the next digital bit, while on a CD-ROM or DVD, the program freezes or is unable to load. Where a scratch occurs determines if your disc is repairable. Data resides on the top side of the polycarbonate disc. It is extremely important to protect this side of the disc. Manufacturers, however, leave this side highly exposed. If a scratch is on bottom it can be repaired however, a scratch on the top, through the foil or the stamped data, will result in lost data and a non-repairable disc.

First step is to determine which side of a CD is scratched. For this:

- i) Hold your disc 24 inches away from a 40 watt light bulb, label side facing the bulb. If you see light coming through pin holes or scratches, this means that the disc is scratched on the label or top side and the top three layers (Graphics, Lacquer and Reflective Foil) of the disc have been removed. This disc is non-repairable in that area and will most likely not play perfectly again, even after it is repaired, but you will be able to play other tracks in areas that have not been damaged.
- ii) Another method is to hold the disc, bottom or play side up, at an angle reflecting the light off the playing surface. Look closely at the scratches on the playing surface.

Scratches or wrinkles in the top side will appear as a single line only. Scratches on the bottom of the disc will have a reflection and appear as double lines. These scratches are repairable.

Minor scratches on CDs can be removed. For this use a soft cotton ball to clean the CD. You may also use any acrylic liquid cleaner. The CD should be cleaned from the center to the outside in single wiping motion while doing this don't spend any amount of time in one spot as the small amount of heat generated by this can "distort the thin data metallisation of the aluminium film inside". Then rinse the CD and pad it (don't wipe) dry using a soft dry towel. Then put it into the CD player and let it spin and run for at least 20 min. This will remove/dry out any moisture in the CD. If a disc is warped, cracked, or punctured it cannot be repaired.

CD Rot

CD rot refers to a gradual deterioration of the data-carrying layer. This problem may be found in optical discs, including DVDs. The rotting is a result of poor manufacturing. The aluminium layer that reflects the light of the player's laser is separated from the CD label by a thin layer of lacquer. If the manufacturer applied the lacquer improperly, air can penetrate to oxidise the aluminum, eating it up just as iron rusts in air. As a result of CD rot the silver colour on the label "side of the CD changes to bronze, copper, golden-brown or rusty-orange colour. When such a disc is played it makes static-like background noise. CD rot is found in old discs only. In case of a CD rot, you should immediately demand a replacement disk from the manufacturer.

DVDs are a bit tougher than CDs in the sense that the data layer (or layers – some discs have two) is sandwiched in the middle of the disc between two layers of plastic. But this structure causes problems of its own, especially in early DVDs. The glue that holds the layers together can lose its grip, making the disc unreadable at least in parts.

Most of the discs are rendered unreadable by poor handling by the owner. If the discs are treated harshly and rubbed against each other, this could lead to the destruction of the fragile protective layer on the CD, allowing the aluminium in the layer to directly interact with the atmosphere. Scratches on the top of the CD can easily penetrate to the aluminium layer thus leading to its degradation. A DVD should not be bent to remove it from a hard-gripping case as flexing the disc puts strain on the glue. Discs should be stored in a cool, dry place. For maximum longevity, discs (CD/DVD) should be stored vertically and only be handled by the edges. Don't stick labels on them, and in the case of write-once CDs, don't write on them with anything but soft water-based or alcohol-based markers. Rewriteable CDs and DVDs, as opposed to write-once discs, should not be used for long-term storage because they contain a heat-sensitive layer that decay much faster than the metal layers of other discs. Keep discs clean. For cleaning the CDs wipe with cotton fabric in a straight line from the center of the disc toward the outer edge. If you wipe in a circle, any scratches may follow the tracks of the CD, rendering them unreadable.

The data from a damaged disc should be transferred onto a new one as soon as possible. For dealing with more badly damaged situations consumer disc repair kits are available and several companies also offer CD restoration and resurfacing equipment and services.

Self Check Exercise

- 4) Mention the two methods commonly used for identifying which side of the CD is scratched.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

14.6 REPAIR OF MICROFILM

Microfilm consists of a layer of emulsion coating embedded in a base of either cellulose or polyester. Polyester-based film is the most durable film base as it absorbs less water and dries more quickly after processing. Silver halide, polyester-base film is most suitable for archival records and is primarily used as a security copy of the records, from which other copies can be made, as it has a potential life-expectancy rating of 500 years. However, silver-halide film has rigid environmental requirements and deteriorates rapidly if exposed to high temperature or humidity, chemical agents or pollutants, or frequent handling. Diazo film is a polyester-based film coated with an emulsion of diazonium salts. It is mainly used for reference purposes, as it can sustain heavy use without scratching and can normally be stored in a filing cabinet in a climate-controlled office environment. Vesicular film and dry silver film are other less commonly used films. Neither of these is recommended for archival microfilming.

All films should be handled by the edges or leaders. Users should always wear gloves when handling master negatives as fingerprints and acidic oils can damage film. Only one microform at a time should be removed from its enclosure. Fiche should be re-sleeved immediately after use. Microfilms should be wound on inert plastic reel. Rubber bands should not be used. In addition, rolled film should never be pulled tight on the reel as this can cause abrasions. Dirty films should be cleaned. Microfilm can be re-washed to remove surface dirt. Before washing the film must be carefully inspected as splices, tears, rips and curling can cause jams in the processor and lead to film damage and image loss. Re-washing may heal minor emulsion scratches in the gelatin layer. However, most scratches or abrasions on the emulsion will remain.

Some of the problems associated with microfilm are redox blemishes, silver mirroring or overall fading. Some processed silver gelatine microfilms in storage for two to twenty years develop small coloured spots or blemishes which are generally red or yellow in colour. Fingerprints and areas where adhesive tape is in contact with the film are common areas for redox to start. Once the deterioration of the microfilm occurs it cannot be reversed. The blemishes result in the permanent obliteration of the affected images. Silver film duplication and Kodak Brown Toner can be used to stabilise the microfilm and prevent or slow degradation of as yet unaffected images otherwise the condition might lead to partial or complete data loss. Microfilm can be given polysulphide treatment which involves use of sulphur compounds to convert the volatile metallic silver in silver film into a very stable silver sulphide which is resistant to oxidation caused by high temperature, high humidity, and atmospheric pollutants. This treatment may be applied during film processing or as a post processing step. This treatment protects the microfilm against redox.

Silver in the microfilm is susceptible to degradation over decades through oxidation and exposure to various atmospheric gases. Airborne contaminants such as air pollution, paint

vapours, building materials, and chemicals in enclosures such as boxes and jackets can lead to silver image deterioration. Film should be stored at a temperature between 60 and 70° F. and a relative humidity between 30 and 40%. Very dry and warm storage conditions can cause film to become brittle, which may be remedied by placing it in an environment of 45-50% humidity for several days.

Vinegar syndrome is another kind of degradation found in microfilms created before 1980 which have a backing made of acetate plastic. When this base of acetate microfilms degrades it release acetic acid which yields a strong vinegar smell. When this acid is released into the air in the film's canister it leads to a rapidly accelerating process of film deterioration. The effected film begins to shrink, bend and curl. In order to stop this degradation storage temperature, relative humidity and acid level should be reduced and microfilms should be duplicated onto modern polyester based silver print microfilm.

Microfilm might get affected by fungus in temperatures above 70° F. and relative humidity above 60%, as in such conditions they multiply rapidly and attack film gelatine.

They result in damage and chemical breakdown causing the gelatine to become distorted, sticky, and soluble in water. Damage from fungi is usually permanent, but most minor fungi can be removed by a qualified vendor. If the microfilms are stored in rusty canisters they should be put into new archival plastic canisters. Microfilm in a storage facility should therefore be inspected periodically to be sure that none of the above mentioned problems has arisen. Because diazo film gives off fumes that can harm silver film, the two should not be stored together.

4.6 SUMMARY

In this unit we studied about some basic book repair procedures and techniques which can be undertaken in-house. We also learnt about the various materials (like paper, repair tissue, adhesives, tapes etc.) and tools (like folder, microspatula etc.) which are required for carrying out simple book repair treatments. We also discussed techniques for cleaning and stain removal with the help of chemicals. Bleaching and de-acidification are some other techniques which can be used for stain removing. Humidification can be used for flattening rolled and folded documents. In this unit we also discussed simple procedures which can be used for repairing audio cassettes, magnetic media, CDs and DVDs, and microforms like roll microfilm. Some basic guidelines for storage and handling of books and other library materials can help reduce the amount of damaged materials. These suggestions should be provided both to the library staff and the users. Non-print materials should also be treated with special care. Microforms should be handled by edges, since fingerprints can obscure the images, and microform and microfiche readers should be cleaned regularly to prevent scratching. Microfilm should be inspected periodically to ensure its longevity. Compact discs and CD-ROMs should also be handled with care and magnetic media like computer discs should not be placed near strong magnetic fields.

4.7 KEYWORDS

- Blotter Paper** : A completely un-sized sheet of paper made of rag or cotton linters, generally used to absorb moisture.
- Book Cloth** : A generic term for the woven fabrics used in covering books. Book cloth can be made of cotton, rayon or silk and is often backed with a layer of paper.

Chain Lines

- : The lines that run parallel to grain of a sheet of laid or hand made paper, usually two one inch apart. The lines are caused by the “chain wires” of a paper mould.

Cinching

- : The wrinkling, or folding over, of tape on itself in a loose tape pack. It normally occurs when a loose tape pack is stopped suddenly, causing outer tape layers to slip past inner layers, which in turn causes a bucking of tape in the region of slip.

Complex Paper Tears

- : A tear that has more than one top and bottom. A complex tear is usually two or more separate tears made over time.

Crash

- : A coarse, open weave, starched cotton material, sometimes napped on one side, and used in library and edition binding for lining the spines of books. This material is also known as super or mull.

Data Layer

- : The layer on an optical disc that holds data as marks or pits.

DVD

- : Digital Versatile Disk (formerly Digital Video Disk). An optical disc with the same physical size as a CD but with significantly greater storage capacity. DVDs can also be double-sided or dual layer.

Document Repair Tape

- : A commercial tape made up of a paper carrier and a stable acrylic adhesive.

Endpapers

- : The two or more pages placed in the front and back of a book between its covers and text block. The endpaper at the front of the book is called the front endpaper, while the one at the back is called the off endpaper.

Feathered Edge

- : The fuzzy effect resulting from water or needle tearing a piece of Japanese repair tissue.

Grain

- : In machine-made paper and board, the direction that the majority of paper or cloth fibers lies. In cloth, the grain is the direction of the warp threads. A well produced book should have the grain running from head to tail so the pages of a book are more inclined to lie flat when the book is open.

Wheat Paste

- : An adhesive made from cooked wheat flour and water.

Splice

- : Editing technique of joining two separate pieces of film together (using tape or cement) to create a continuous piece

Life Expectancy (LE)

- : The number of years a microfilm, an optical disc etc. is expected to be useful.

- Optical Disc** : A plastic disc that is “written” (encoded) and “read” using a laser optical device. It can store digital data as tiny pits etched in the surface.
- Oxidation** : A chemical reaction between oxygen and another substance, causing the original substance to have its properties altered.
- RH** : Relative humidity.

14.8 ANSWERS TO SELF CHECK EXERCISES

- 1) Various glues used for book repair are:
 - i) **Animal Glues:** These glues are water-dispersant gelatines made from the hides, bones, hoofs and horns of cattle. It is used mainly because of its bonding strength. Flexible glue is used for spines where flexibility is an advantage. In recent years, animal-based glues have been replaced with synthetic vinyl resin glues, the most common of which is polyvinyl acetate emulsion.
 - ii) **Polyvinyl Acetate (PVA) and polyvinyl alcohol:** These are adhesive glues which can be thinned with water for different consistencies and effects. These are available under different brand names e.g. Spynflex, jade 403 from Talas etc. PVA has low moisture content and dries quickly. It is flexible when dry, and therefore can be used to tighten hinges, repair book cover corners and reattach loose book cloth to book board.
- 2) The various steps involved in repairing the hinge of a book, which has a loose text block with endpaper still attached to it, are:
 - Before undertaking repair of the hinge, inspect the hinge carefully.
 - Stand the book on its tail and open the loose hinge with one hand.
 - Take one knitting needle dipped in adhesive, and insert it into the hinge as far as possible, using a twirling motion. Apply the adhesive thoroughly.
 - Turn the book on its head and repeat the same procedure on this end.
 - Lay the book flat on a table. Put the text block squarely in its case and press the book cloth into the case joint using the long thin edge of a bone folder on the outside of the cover to adhere the crash, end paper and book board.
 - Now open the book cover and gently press the endpaper into the hinge with a bone folder.
 - Then insert a sheet of waxed paper as far as possible back into the hinge.
 - Leave the book to dry for several hours or over night, in a book press.
- 3) Sticky tape and Sticky Shed are the two phenomena associated with the deterioration of the magnetic tape finder. In sticky tape phenomenon one or more parts of a tape may adhere to other surfaces. It is generally caused by breakdown of the binder or the back coating and is characterized by softer than normal binder coating, higher fiction and gummy tape surface residues. It results in blocking, oxide loss, heat clogs, sticking and slipping of the tape as it moves across the heads and squealing of audio tapes. Sticky shed occurs when the deposits (i.e., oxide, etc.) from magnetic tape rub or wear off onto the various parts of the equipment, when a sticky tape is played.

4. Two methods commonly used for identifying which side of a CD is scratched are:
 - i) First method involves holding the disc 24 inches away from a 40 watt light bulb, label side facing the bulb. If light coming through pin holes or scratches is visible, this means that the disc is scratched on the label or top side and the top three layers (Graphics, Lacquer and Reflective Foil) of the disc have been removed. This disc is non-repairable in that area and will most likely not play perfectly again, even after it is repaired.
 - ii) Another method is to hold the disc, bottom or play side up, at an angle reflecting the light off the playing surface. Look closely at the scratches on the playing surface. Scratches or wrinkles in the top side will appear as a single line only. Scratches on the bottom of the disc will have a reflection and appear as double lines. These scratches are repairable.

14.9 REFERENCES AND FURTHER READING

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UNIT 15 MICROFILMING AND DIGITISATION

Structure

- 15.0 Objectives
- 15.1 Introduction
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 - 15.2.1 History and Concepts
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- 15.9 Keywords
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15.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the basic concept of microfilming, the various microforms, types of microfilm;
- discuss the various advantages and disadvantages of microfilm as a medium for preservation;
- understand the digitisation and its basic concepts;
- learn about the digitisation of text, images, audio and video;
- discuss the various digitisation projects going on all over the world and in India;
- discuss the advantages and disadvantages of digitisation.

15.1 INTRODUCTION

Newspapers, books, manuscripts and archives have been filmed for decades in order to protect them from the deterioration of paper, or from other causes of damage, which threaten books and archival material, and to ensure the permanence of the information they contain. Microfilm is used in libraries for storing back issues of magazines/newspapers and in museums for storing old valuable documents so that the originals need not be handled. Large organisations may also store documents on microfilm to save storage space. When properly produced and stored in accordance with international standards, microfilm has the advantage of maintaining access to information for hundreds of years. Digitisation has introduced possibilities that seem limitless and advantages like enhanced access, diminished costs, versatile capabilities and usage. Libraries and institutions are now taking initiatives to exploit the new media for preservation purposes. However, the technology for preserving digital materials is still in developmental stage and requires substantial investments to be made. This unit discusses some of the issues related to microfilming and digitisation and their significance in the context of preservation.

15.2 MICROFILMING

Preservation of a document often involves copying or reformatting of information from one form to another in order to preserve it. This is also known as preservation reformatting. Microfilming is an example of reformatting technique. Other techniques are photocopying and digitisation.

In microfilming images are reduced to such a small size that they cannot be read without optical assistance. This photographic compression leads to saving of space and is of enduring value. Microfilm has an estimated lifespan of 500+ years when stored in proper condition. Moreover, a roll of 35mm microfilm can hold about 900 pages and a roll of 16mm about 3000 pages.

Rare valuable archival documents deteriorate with time. This could be because the paper they are recorded on is of poor quality, the conditions of storage are adverse or because of frequent use. By microfilming the information recorded in these documents can be preserved and retrieved/used as and when required. This saves the original document from further damage even after the original has deteriorated and become unusable. The original documents or records could be in the form of brittle and decaying books, newspapers, maps, plans, and archival documents such as diaries and manuscripts. These rare and valuable records can be microfilmed to preserve them from loss and destruction over time. In the case of valuable documents, which might become damaged by constant use, a microfilm copy of it may be made and stored separately. The film used is safety film and if properly processed it will last longer than the originals. If possible, the microfilm copy may be given to the reader for reference purposes which will not only prevent the original from damage by constant use but will also protect it from danger, such as fire, natural disaster, etc.

15.2.1 History and Concept

Although the principles of microfilming have been known for over 150 years, it is only after the Second World War that the use of microfilming methods became very popular as a technique for reproducing the printed page. Soon after the invention of photography, the need and applications of reduced size of copies were realized. In 1839, John Benjamin Dancer, an English optician, produced micro-documents, which could be viewed with a microscope. He reduced a 20" documents to an image of 1/8" in length. Utilising Dancer's techniques a French photographer and chemist, Rene Dagron, obtained the first patent for microfilm in 1859 and began the first commercial microfilming enterprise. The application of this technique came into prominence only during the Franco-Prussian war in 1870 when carrier pigeons were used to transport microfilmed messages across German lines to the besieged city of Paris. During World War II microphotography was used extensively for espionage and for regular military mail. Letters going overseas were sent on microfilm, and a hardcopy was produced and forwarded at the receiving side. Because of war a threat of destruction to the records of civilization was realised, which led to the need for the microfilming of records, documents, archives and collections. After the war it was proposed that microforms be used for active information systems and for preservation of material. In the 1970's the information explosion forced libraries and institutions and their users to microforms as an alternative to bulky expensive print materials. By the 1970's libraries and institutions began to use microfilming as an alternative to bulky expensive print materials and the improved technology also increased computer output microform applications. The application of microfilming was thus realised by the libraries and librarian in the late 19th and early 20th century.

Roll Microfilm: It is the commonly used microform with images arranged in a linear array. The typical film widths are 16mm, 35mm, 70mm and 105mm. The film lengths range from 50 feet to more than 1000 feet, with 100 and 215 feet being the most widely encountered in library applications. The film may be unperforated or perforated along one or both edges, Non-perforated film is usually preferred for maximum utilisation of film area. A 100 feet reel of 16mm microfilm can store miniaturised images of 2,500 to 3,000 pages reduced by a ratio of 24:1. However, the recording/storage capacity of microfilm depends on the reduction ratio.

Unitized Microfilm: To facilitate ease of search of a document, the roll microfilms are many times split into small lengths, each of which becomes a unit, referred to as unitized microfilm. A strip of unitised microfilm usually contains 6 frames, the first frame being the title of the document. Thus, each strip of microfilm contains usually 10 pages of information.

Aperture Card: The aperture card is an opaque card of approximately 7”x 3” with an aperture at the right hand side for mounting a single 35mm frame. The card contains information about the image and is easy for storage and retrieval. Aperture cards are found heavily used in art, engineering and geography related departments. A sample of the aperture card is given below.

Class No	:	_____
Acc. No	:	_____
Title	:	_____

Description	:	_____

Fig. 15.1: Aperture Card

Microfiche: Microfiche was first developed by Dr. J. Geobel of the Netherlands. It consists of a number of rows of reduced images of documents produced on a transparent

sheet of film, using a special “Step and Repeat” camera. The microfiche is produced in variety of sizes, but the most common size is 105mm×148mm. the top of the fiche contains an eye legible image giving information about the content of the microfiche. Depending on the ratio of reduction, the microfiche vary in the number of frames. Ninety-eight frame microfiche are commonly found in libraries. Microfiche can be easily transported from one place to other and hence, now-a-days a number of publications are available in microfiche. Some commonly found reduction ratio and frame numbers per microfiche are given in table 15.1.

Table 1: Microfiche Reduction Ratio and Number of Frames

Reduction Times	No. of Rows	No. of Column	No. of Frames
18	05	12	60
24	07	14	98
42	13	16	208
48	15	18	270

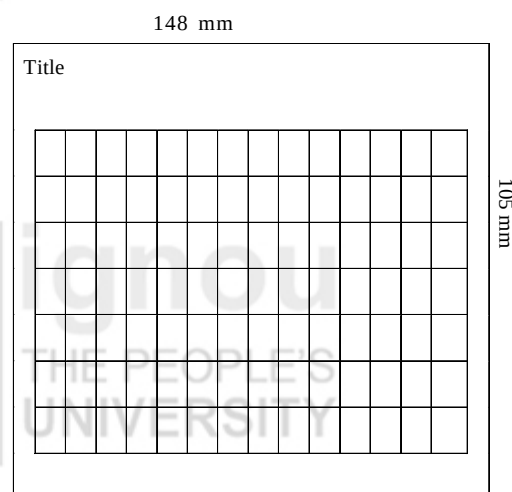


Fig. 15.2: Microfiche (98 frame)

Ultrafiche: It is fiche of the same size to that of microfiche, having significantly high number of frames. The original is reduced over 100 times to prepare ultrafiche. This is possible due to the availability of high quality film. Ultrafiche requires extreme care, as a small scratch can impair legibility of a number of frame due to its high frame capacity.

Micro-Card: This is an opaque card of 3”x5” size containing a number of rows of reduced images produced by photographic process.

Micro-Print: It is larger than micro-card having a size of 6”x 9”. The images are printed by photolithography. Each card consists of 100 images with an eye-legible bibliographic reference along one side.

Microlex: The microlex cards are approximately of 6.5”x8.5” size and contain 200 pages on one side. The image are produced by photographic methods.

Self Check Exercise

- 1) Mention the common forms of microfilms in use with two sentences on each.

Note: i) Write your answer in the space given below.

- ii) Check your answer with the answers given at the end of this Unit.

Stability of Recorded Information

The information content of the microform is of utmost importance. American National Standard has identified 3 levels of stability of processed microforms/microfilms:

- i) Archival Microfilms: Retaining original information-bearing characteristics indefinitely. They are suitable for preservation of information of permanent value.
- ii) Medium-term Microfilms: Retaining the original information bearing characteristics for at least 10 years.
- iii) Long-term Microfilms: Retaining the original information bearing characteristics for at least 100 years.

In fact, the level of stability associated with any given microform depends on various factors including the composition of photographic emulsion and microfilm base materials, the manner in which the film is developed and the conditions under which it is stored or used.

Depending on the type of emulsion type used the microfilms are of three types - Silver, Diazo and Vesicular Microfilm.

Silver-Halide Microfilm: It is high performance, fine grain photographic medium suitable for archival purpose. The photosensitive emulsion in the film contains silver halide crystals suspended in a gelatin matrix coated into a substrate composed of cellulose triacetate or polyester teraphthalate or cellulose nitrate. Cellulose nitrate base microfilms are not common these days. The stability of processed silver halide microfilm may be affected by substrate characteristics as well as the characteristics of the chemical compounds used in the photographic recording process. All acetate and polyester based films are subject to dimensional changes associated with aging and environmental effects. In most cases, such changes are slight and have no impact on the utility of recorded information. Polyester based films may shrink by 0.03 percent over a period of 10 years, while acetate based films may shrink as much as 0.7 percent during the same period. Microfilm size also expand due to increase in temperature, the acetate or polyester based material may adhere to the emulsion layer of the portion of film wound immediately below it to separate the silver halide emulsion from its base, causing loss of recorded information. This problem is typically attributable to incomplete drying of processed film, prior to winding onto reels, high humidity in storage area, etc. For nitrate based films the stability is relatively less due to inflammable nature of the film. They are highly combustible and can ignite spontaneously at about 40 degree Celsius.

Diazo Microfilm: The diazo microfilms are usually used for duplicate or working copies. The emulsion used here is of diazonium salt. Usually the diazo films have a medium term stability with a usable life expectancy of at least 10 years. The diazo microforms may fade

when exposed to light, including light encountered during usage. In diazo films the images are embedded in the base material as contrast to silver halide films, where the image is fixed to the base. Due to this the diazo films are less vulnerable to abrasion.

Vesicular Microfilm: the vesicular process is a system of dry photography involving exposure to ultraviolet light and development by heat. The vesicular microfilm consists of a light sensitive emulsion and when suspended is hard, but when exposed to ultraviolet radiation, pressure pockets/vesicles are formed as images. The images are then passed through heat for development and withdrawal of heat fixes the image and the film becomes hard. Stability of recorded information is similar to that of diazo films, but certain vesicular microfilms having long term storage potential may remain stable for 100 years when stored under controlled conditions. At high temperature, the vesicles collapse leading to loss of image. During storage, certain vesicular films release hydrogen chloride gas, which in the air produces hydrochloric acid. This has a corrosive effect on metal enclosures, film cans and cabinets. However, this corrosive effect has no harmful impact on the microfilm itself.

Self Check Exercise

- 1) Substrate characteristics can affect the stability of recorded information in microfilms. Comment.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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Advantages and Disadvantages of Microfilming

Advantages of Microfilming

i) Life Expectancy

The major advantage of microfilming is its durability and long life expectancy. As mentioned earlier a microfilm can last up to 500 years. For this it should be manufactured and processed to international quality standards; and stored under optimum environmental conditions.

ii) Storage Space Reduction

Another major advantage is that microfilm is very compact. A huge amount of information can be stored on microfilm in a much smaller space as compared to paper etc. Records reduced to microfilm occupy as little as 2% of space required for the original paper documents. Microfilming can help in realising a space saving of upto 98%.

iii) Security of Information

Microfilm helps to ensure security of vital or archival information. Once filmed it is not possible to manipulate the image on microfilm. To ensure preservation a separate security

or master copy of the microfilm, on a polyester film base should be kept under strict security and environmental conditions. Moreover, retention of a master film copy acts as on backup ensuring that any tampering will be detected. This helps in maintaining the authenticity and integrity of the information.

iv) Economical

Another advantage of microfilming is savings in storage costs or records. The storage equipment requirements are less and thus economical. Microfilming also provides increased flexibility, and productivity in information management. Microfilms can be economically created, duplicated and distributed.

v) Time-tested Method

Microfilming has a well-proven history, as library material has been reproduced in microformats since 1930s. Longevity of the microfilmed information has been tested and problems, if any, with the technology have largely been ironed out.

vi) Reducing Stress on Original Documents

Creation of a microfilm copy provides an added benefit of reducing stress on the original material. Microfilming also helps to ensure the possibility of providing wider access by making duplicate copies for a range of users around the world. As once a record is microfilmed, it is easy and relatively inexpensive to make multiple copies of it by duplicating the film.

vii) Option to Digitise

Microfilm can also be digitised if good quality film has been used. Various reasons for microfilming of records exist.

Various reasons for microfilming of records exist. These factors can be used as measure to decide whether a particular record should be microfilmed or not. These factors are:

i) Condition of the Document

Condition of the document is the major determinant for its being microfilmed. The degree of deterioration or fragility should be considered. Records that are deteriorating, brittle, worn or water damaged can be microfilmed in order to preserve the information contained in them. Records that are beginning to show signs of disintegration can also be microfilmed to save them from further damage.

ii) Rarity

Microfilm is most useful for documents and records like manuscripts etc. which are rare and of intrinsic value. The degree of rarity is another factor that helps in microfilming whether a document should be microfilmed or not.

iii) Frequency of use

The level of usage of a record is another criterion to be considered for microfilming. Records that are used frequently are perfect candidates for microfilming, as microfilming will save on wear and tear of the originals that can be retained for preservation and enable production of multiple copies for use.

iv) Volume of Space Occupied

The volume of space occupied by the original records should be considered. Due consideration should be given to the fact that microfilming a large volume of record does save storage space but might cost more than what is required to film a small volume of record.

v) Value

Monetary, aesthetic and historical value attached to a record makes it more eligible to be microfilmed. All archival records valuable, however, some records like records of on going legal value, of high replacement cost or records that are irreplaceable, if lost, have more impact than others. Therefore, they should be microfilmed in order to securely preserve them.

vi) Maintaining the integrity

Microfilming safe grounds a document against manipulation. Therefore, if a document is of intrinsic value and its authenticity and integrity needs to be preserved it can be considered for microfilming.

All these factors should be considered before microfilming a document.

Disadvantages of Microfilming

- i) **User Resistance:** The microfilmed records require a machine to be read. Often the microfilm reading machines in Libraries are of poor quality and not designed for human comfort. Usually, the users have to access the film manually by locating the film, loading it onto a machine and then spooling through dozens of microfilms to locate the one that is required or is of use. Therefore, some users are reluctant to use microfilm.
- ii) **Cost:** Microfilming can be expensive. Costs incurred on microfilming include costs of equipment, cost of preparing documents for microfilming, and cost of producing indices and retrieval aids like microfilm readers etc.
- iii) **Technical Limitations:** Microfilming has certain technical limitations also. If a document is faded, badly stained the microfilm image of that document will also be of poor quality. Moreover, the production of high quality archival microfilm is based on knowledge of technical requirements and imposition of rigid quality controls. Without this, even original documents in excellent condition can result in poor quality microfilms. Image quality can be determined only after filming is complete. Bad pages, if any, must be re-filmed and spliced in.
- iv) **Damage to the Original:** The archival records being fragile may get damaged during the filming process. The microfilming process involves opening a bound volume and exposing the contents and filming it. This might crack or break binding and pages etc. if the original records are to be destroyed after filming this is not problematic. However, if the originals are to be retained, this is a drawback of the microfilming process.

The microfilms are used mainly for preservation purpose, but their use can't be restricted and, hence, there should always be at least two copies of the same document, one master and the other working copy. Master copies are seldom used or referred to. They are only used for duplicating purpose. Master copies should always be prepared by using silver halide microfilm, which has permanent life.

Self Check Exercise

- 2) What are the factors that should be considered while selecting material for microfilming?

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

15.3 BASIC CONCEPT OF DIGITISATION

Digitisation may be defined as the process of converting information into a digital format. In this format, information is organised into discrete units of data (called bits) that can be separately addressed (usually in multiple-bit groups called bytes). This is the binary data that computers and many devices with computing capacity (such as digital cameras and digital hearing aids) can process. Also referred to as image capture, is the process of creating a digital representation or image of an original through scanning or digital photography. Digitization is a precondition for electronic storage, such as magnetic storage, storage on optical disk, and character recognition (eg, ICR, OCR).

By mid 1990's with the emergence of new technologies the shortcomings of microfilm as a medium of preservation become apparent. One of the earliest attempts at digitisation was undertaken at the British Library. The Electronic *Beowulf* project began as part of the British Library's "Initiatives for Access" programme to make its collections more available to the public through new technologies. The project produced the digital version of the unique late tenth-century manuscript of the Anglo-Saxon poem *Beowulf*, which was damaged by fire in 1731. High definition digital images of the valuable manuscript were made available to the scholars thus enabling new ways of accessing examining and researching the rare manuscript. This was made available in a CD-ROM which included "an electronically enhanced visual version of the text of the manuscript itself, important 18th-century transcripts of the damaged original, a translation, a glossary, a textual commentary, references to relevant archaeological material and other editorial matter" (Feather, 1996). This attempt proved "the unlimited potential of digitisation as a tool for the preservation of texts and furtherance of scholarship" (Feather, 1996). The Electronic *Beowulf* project has till now assembled a huge library of digital images of the *Beowulf* manuscript and related manuscripts and inaccessible printed texts. Under the *Initiatives for Access* programme one project DAMP i.e., the Digitisation of Ageing Microfilm Project, highlighted the potential shift from microfilming to digitisation. The microfilms of Burney collection of Early English Newspapers, a national collection of 18th Century London newspaper titles, were in a deteriorated state and the originals were too fragile to be re-filmed. DAMP aimed to digitise this collection by converting one surrogate form into another thus widening the access to content and making the texts available in a more convenient and machine-readable form. The British Library also started the International Dunhuang Project in 1993 to promote the study and preservation of manuscripts and printed documents from Dunhuang and other Central Asian sites through international co-operation. One of the pioneering project is Turning the Pages Programme (<http://www.bl.uk/onlinegallery/ttp/ttpbooks.html>). Under this programme a system is developed using high quality digitised images, interactive animation and touch screen technology to simulate the act of turning the pages of book. The user can virtually 'turn' the pages of manuscripts in a realistic way, zoom in on digitised images and read or listen to notes provided for each page. The British Library is now offering this service for institutions, museums and libraries

around the world to provide the user's access to the precious books and manuscripts while keeping the originals safe.

In US also in the 1990s a number of high profile projects were taken up. The main purpose behind these digitisation projects was to digitise the text and thus preserve the intellectual content of the 19th century books which were rapidly deteriorating due to high acid levels in the paper. In present scenario a large number of programmes of digitisation of libraries and archives are being taken up. These programmes are primarily driven by use.

The Digitisation Process

The process of digitisation involves converting the existing library material into digital format. The physical or analog object is 'captured' by some device such as a scanner, digital camera or recorder, which converts the analog features of the object to numerical values, enabling them to be read electronically (Eadie, 2005). The information is stored in digital form, i.e., in the form of ones and zeros as bits and bytes. In library the information is usually available in the following forms – text, image, audio and video. Now let us discuss in detail the digitisation of material in each of these forms.

Digitisation of Text

Digitisation of existing texts can be carried out through two main methods – transcription and Optical Character Recognition (OCR).

Text Transcription: This is the simplest method of digitisation and can also be referred to as keyboarding. This method involves use of a keyboard for entering data into a computer system. This is helpful in case of documents with complex layouts and passages of text that are difficult to read. For example, hand written diaries with notes in margins or newsprint comprising blocks of unrelated text on that page. Voice-recognition softwares can also be used for transcription of text. These softwares can recognize the human voice and convert its sounds into digital form.

Keyed in text is usually saved in the form of ASCII files which are plain/simple text files, that permit searching by keywords or phrases. However, ASCII files do not replicate the structure and format of an original document. Unicode is another text format, which aims to enable mapping of all the characters in all the languages of the world onto a distinct numerical code. Till now, Unicode offers mappings for all the major languages.

Electronic transcriptions of texts are also stored and processed as marked-up files. Another emerging format for digital texts is SGML i.e., Standard Generalized Markup Language and XML i.e., eXtensible Markup Language. XML is a simple, very flexible text format derived from SGML. Its primary purpose is to facilitate the sharing of data across different systems, particularly systems connected via the Internet. One SGML application, the Encoded Archival Description (EAD), is being used to create electronic versions of archival finding aids.

Scanning: Scanning using OCR software, is another method which is used to digitise text. This is an automated method which involves scanning a document and then using a computer programme to process the resultant digital image. This method is faster than transcription and also economical, however it is useful in case of clearly typed documents with simple layout. Different types of scanners available in the market are -

- i) Flatbed scanners – These are used to capture images of bound volumes (books), manuscripts, Journals etc.
- ii) Faceup Scanners – This can scan without touching the source document.

- iii) Feed-through scanners – These are used for scanning loose sheets
- iv) Hand Scanners – These are suitable for scanning selective sections of data.

Scanning software comes with the scanner and helps to create image files in formats such as TIFF, JPG, GIF etc. In addition to this, image editing software is also used which helps to work on the image after it has been scanned.

OCR software enables converting an image of text (usually captured by a scanner) into computer editable text or to translate pictures of characters into a standard encoding scheme representing them in (ASCII or Unicode). In this technique first a scanner is used to produce a digital image of the text, then OCR software makes use of stored knowledge about the shapes of individual characters to convert the digital image into. OCR software allows the option of maintaining text and graphics in their original layout as well as plain ASCII and word processing formats. Some of the commonly used OCR softwares are Caere's Omnipage and Xerox Textbridge, ABBYY Fine reader. The Omnipage Pro 11.0 version provides the option to convert the image file into the PDF file format directly including other formats like .html, .doc, .xls etc.

Digitisation of Image

Some of the widely used file formats for images are – GIF (Graphics Interchange Format) and JPEG (Joint Photographic Experts Group), PNG (Portable Network Graphics specification). The images could be stored as Raster (or Bit-mapped) images or Vector images.

Raster images are made up of pixels (i.e., picture elements) which are similar to grains in a photograph or dots in a half tone. Each pixel stores information about the colour of an image and can represent a number of different shades or colours depending upon how much storage space is allocated for it. Raster images are commonly stored in the file formats JPEG and GIF.

Vector graphic is another type of image. These images are co-ordinate based, i.e., two points a and b define a line, and three or more points, define an area. Vector graphics are often used in virtual reality and 3-D modeling, as well as in Macromedia Flash application. A common file format used to create vector graphics is Encapsulated Postscript (.ps). Scalable Vector Graphic (.svg) is a newer format that utilises XML technologies.

Resolution of an image concerns the number of pixels held within the digital file, and is measured in pixels per inch (ppi) or dots per inch (dpi). The resolution determines the quality of the images. High resolution has more ppi or dpi, therefore, greater density of colour formation and also larger file size.

Images also just like text and can be captured with help of devices like scanner and digital cameras. Digital Cameras are usually used for digitising colour images. It does not come into contact with the original documents.

The storage space required for saving images in digital format is depended on various factors like the linear dimensions of document, the scanning resolution, the mode of digitisation used etc. Despande and Pange (2000) have given a formula for calculating the number of bytes required to store a single page given size.

$$s = \frac{(H \times R \times B) \times (W \times R \times B)}{8} \times \frac{1}{C}$$

S = the storage requirement per page in bytes

H = the height of a typical subject document in inches or millimeters

- W = the width of a typical subject document in inches or millimeters
- R = the scanning resolution in pixels per inch or millimeters, along the documents horizontal and vertical dimensions
- B = the number of bits utilised to encode each pixel and
- C = an image compression factor

Digitisation of Audio

The audio data present in libraries is in analogue form. To digitise it the audio player should be attached to a computer system through audio capture card and then sound should be recorded into the system. The process of converting analogue sound to digital sound is called sampling. This conversion involves sampling the original sound many times per second. The frequency of this sampling rate is measured in Hertz (Hz), and the range of each sample is measured in bits (Eadie, 2005). Common uncompressed file formats are .wav (for MS Windows), aiff (for Mac OS). These formats provide high quality lossless sound files but the files are large which renders them unsuitable for dissemination over the web. A common compressed format is .mps which enables huge reductions in file size of upto one twelfth of .wav files.

Digitisation of Video

A digital video file is a sequence of still images (frames) played in rapid succession, unusually accompanied with audio data played in tandem. The digitised file can be saved in formats like .mov, .avi (audio, video interleaved), .mpeg, .qt (Quicktime), .divx. CODEC (Compression and Decompression or Coder or Decoder) is generally used for video compression. CODEC software compresses and then decompresses the data on play. Quicktime, Real Media and Windows Media video are some of codecs available for playing desktop video but these should not be used for master archival version of a video file.

The entire process of digitisation, from preparation and conversion to presentation and archiving encompasses a range of procedures and technologies. Before taking up any digitisation programme or digital project, a number of factors should be considered. These factors include assessment of the intellectual and physical nature of the source materials, the number and location of current and potential users, the current and potential nature of use, the format and nature of the proposed digital product and how it will be described, delivered and archived, how the proposed product relates to other digitization efforts, and projections of costs in relation to benefits. The issues related to a particular project vary depending on the country in which the project is based, the country in which the source materials were produced, and the existing legal agreements. Before digitising the physical nature, size and condition of the original materials must also be taken into account. Alternative modes of digital storage and delivery must also be considered. Before taking decisions about digitisation factors such as the physical size, nature and condition of source materials should be taken into account. Other factors that need to be considered are the resultant digitised product, file size, associated storage needs and processing requirements. The factors that contribute to the overall success of the digitisation programme are the organisation of the digital data, its indexing, delivery to the users and maintenance over time.

Self Check Exercise

- 3.) Write a brief note on scanning with OCR technique.

Note: i) Write your answer in the space given below.

- ii) Check your answer with the answers given at the end of this Unit.

15.4 ADVANTAGES AND DISADVANTAGES OF DIGITISATION

Advantages of Digitisation

Digitisation offers considerable advantages. Some of these are:

- i) **Easy Access:** One of the major advantages of digitisation is that it allows increased access to the object. Digitisation offers quick and easy access to multiple users simultaneously from anywhere in the world. Thus it enables equal access to a widest range of users. The various digital objects can be easily incorporated into instructional and educational applications.
- ii) **Easy duplication:** The digitised information can be reproduced to create multiple digital copies without any loss of quality. Duplication does not degrade the master file.
- iii) **Automation:** The process of making copies can be automated as the document is made up of a string of binary numbers. It is also possible to generate copies at a very high speed.
- iv) **Ease of Search and Retrieval:** Digitisation enables quick and easy searching of the material available in digital format independent of location. Various search and retrieval techniques, indices and other tools are being devised for text, image, audio and video material existing in digital format.
- v) **Less Storage Space Requirement:** Digitisation leads to a high degree of storage space compression. The digitised information requires less storage space which in turn leads to reduction in running costs.
- vi) **Image Enhancement:** Image can be electronically restored and enhanced by eliminating extraneous stains and marks and restoring faded colour. Similarly, legibility of faded and stained documents can be improved. Image enhancement enables the researchers to analyse the details that cannot be seen by the human eye unaided.
- vii) **Ease of use:** The digitised material can be used in a variety of ways for instructional and research purposes. The digitised text and images can be manipulated and customized according to the user needs. Using digital images there are much greater possibilities for customising the images for specific purposes, and re-using the original images repeatedly without loss or deterioration
- viii) **Purposeful Collaboration:** If an institution has digitised a collection it can be accessed by other institutions and then integrated into their own virtual collections depending on copyright restrictions. This can in turn reduce the wastage of time and money required for digitisation.

Disadvantages of Digitisation

Durability of the physical media used to store data. For example estimated life of optical disk is about ten years.

- i) **High costs:** The equipment required to carry out the digitisation process is expensive. Skilled manpower is required to carry out the digitisation work. The digitised collection needs to be stored in a controlled storage area with increased energy consumption, which adds to the costs. Maintenance may require frequent copying which is also expensive.
- ii) **Technical Problems:** Degradation and obsolescence of the media used for storing digital information and software used for manipulation of the stored digital information are the two major issues related to digitisation. Moreover, new computer systems and peripherals are being introduced. The tapes and disks used for storing digital information are all subject to physical decay and need to be stored under controlled conditions. There is a need for refreshment i.e., transferring of digital materials to a new media, at regular intervals to prevent loss because of deterioration of storage media.
- iii) **Lack of Standards:** There is a lack of standards as the guidelines and best practices for producing and maintaining digital objects for the long term are in the development stage.
- iv) **Authenticity of Data:** It is difficult to ascertain the authenticity and integrity of an image, or text when it is in digital form, as it is very easy to manipulate and tamper with data in digital form.
- v) **Copyright Issues:** Intellectual property rights hinder the preservation of digital documents. Various copyright issues need to be resolved before taking any steps to preserve the materials. Copyright legislation places such rigid limitations on copying that even transferring files to the library's system may constitute an infringement of the rights of owners and creators. (Lusenet, Preservation of Digital Heritage, 2002). The complexity of copyright issues can, however, be avoided by working with documents that are out of copyright.

Digitisation for Preservation

The question which is most widely debated is whether digitisation is the most suitable method of reproduction in comparison to methods like microfilming or photography. Digitisation offers limitless possibilities and efforts are being made for exploiting the new media for preservation. However, for certain materials like monochrome originals (newspapers, archives etc.) microfilming still offers the best and most cost-effective form of reproduction and preservation (Gallop, 2002). A book can be placed on a shelf and read even after 100 years time the same cannot be said about CD-ROMs, CD-ROMs will require a plan for immediate attention if they are to be accessible (and useable) even after a decade (Russell, 1999). Digital data is so much dependent on unstable and fragile technology that it cannot be considered as a long-term preservation medium.

Microfilm is a reliable system that is well-tested and digitisation provides immediate access and ease of use with the possibility of remote access. According to Smith "Though digitisation is sometimes loosely referred to as preservation, it is clear that so far, digital resources are at their best when facilitating access to information and weakest when assigned the traditional library responsibility of preservation". The researches are of the view that in preservation the enormous potential of digitisation for access should be combined with the stability of microfilms for long term storage.

Self Check Exercise

- 4) Mention the major advantages of digitisation.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of this Unit.

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15.5 MAJOR PROJECTS OF DIGITISATION

Project Gutenberg

Project Gutenberg (PG), founded by Michael Hart in 1971, is the oldest digitisation project. It is a volunteer effort to digitise, archive, and distribute cultural works. The project is named after Johannes Gutenberg, the 15th-century German printer who propelled the movable-type printing press revolution. The mission of the project is “to encourage the creation and distribution of eBooks”. The project aims to make the items in its collection as free as possible, in long-lasting, open formats that can be used on almost any computer. The United States Declaration of Independence was the first Project Gutenberg e-text. The project started as an ambitious effort to develop a free public library of 10,000 public-domain e-books and now has more than 16,700 items in its collection, with new e-books posted most days. Earlier most text was entered manually but now image scanners and optical character recognition software is used. The status of the ebooks is carefully verified according to U.S. copyright law. Material is added to the PG archive only after it has received a copyright clearance, and records of these clearances are saved for future reference.

The collection contains works of literature from the Western cultural tradition. In addition to literature like novels, poetry, short stories, and drama, the collection also includes cookbooks, reference works, issues of periodicals and a few non-text items such as audio files and music notation files. Most of the texts are in English, but there are also significant numbers in German, French, Italian, Spanish, Dutch, Finnish, Chinese, and many other languages. Project Gutenberg e-texts are made available in plain text, mainly using US-ASCII character encoding but frequently extended to ISO-8859-1. ASCII format was chosen to ensure easy access and readability. PG is made up entirely of volunteers who work on producing these ASCII texts. The Project Gutenberg Philosophy is to make information, books and other materials available to the general public in forms a vast majority of the computers, programs and people can easily read, use, quote, and search. The ebooks can be freely downloaded and read, and redistributed for non-commercial use

Project Gutenberg has led to a number of like-minded projects all over the world which are sharing the project Gutenberg name. Some of these projects are:

Project Gutenberg Australia (<http://www.gutenberg.net.au/>) provides works by Australian writers, and about Australia, which are public domain in Australia according to the Australian copyright law.

PG-EU (<http://www.gutenberg.nl>) is a sister project which aims to facilitate availability of creative works of European origin, under the copyright law of the **European Union**

Project Gutenberg Europe (<http://pge.rastko.net/>) is a project focused primarily on digitizing European cultures, under European copyright laws, and is run by **Project Rastko** in Serbia-Montenegro.

Project Gutenberg Luxembourg (<http://www.gutenberg.lu/>) publishes mostly, but not exclusively, books that are written in **Luxembourgish**.

Project Gutenberg of the Philippines (<http://www.gutenberg.ph/>) is project which focuses on the Philippines and Philippine languages.

Library of Congress

The Library of Congress began a pilot programme in 1990 which aimed to digitise some of the Library of Congress's unparalleled collections of historical documents, moving images, sound recordings, and print and photographic media. The programme later grew into American Memory historical collections. American Memory provides free and open access through the Internet to written and spoken words, sound recordings, still and moving images, prints, maps, and sheet music that are a part of American history and culture. The programme identified audiences for digital collections, established technical procedures, wrestled with intellectual-property issues, explored options for distribution such as CD-ROM, and began institutionalising a digital effort at the Library. After five years in 1995 the Library of Congress began the National Digital Library Programme, a systematic effort to digitise some of the foremost historical treasures in the Library and other major research archives and make them readily available on the Web to Congress, scholars, educators, students, the general public, and the global Internet community. The Library of Congress's National Digital Library Programme (NDLP) aims to assemble a digital library of reproductions of primary source materials to support the study of the history and culture of the United States. In order to reproduce collections of books, pamphlets, motion pictures, manuscripts and sound recordings, the Library has created a wide array of digital entities: bitonal document images, greyscale and colour pictorial images, digital video and audio, and searchable texts. To provide access to the reproductions, a range of descriptive elements, like bibliographic records, finding aids, and introductory texts and programmes etc., were developed. A variety of tools like scanners, digital cameras, devices that digitise audio and video, and human labour for rekeying and encoding texts, was used for creating the reproductions. Formats like SGML, TIFF (for images), JPEG, RealAudio (for audio), Quicktime (for moving images), and MrSid (for maps) are used for digitised material.

Etext Archives

The Etext Archives (<http://www.etext.org/>) were founded by Paul Southworth in 1992. The archives aim to provide access to "electronic texts of all kinds, from the sacred to the profane, from the political to the personal". The mission is to provide electronic versions of texts without judging their content. The material provided includes e-zines, politics, fiction, poetry, books and religious texts. It does not include software, business or marketing newsletters, or other works of commercial nature. The Etext Archives provides content hosting services to people or organizations seeking to make their documents, periodicals, books, and/or works of fiction available to the public. The material exists in document

formats like ASCII text, HTML (and associated popular image formats), PDF, and PostScript. The Etext Archives operates entirely on volunteer labour and equipment

The Million Book Project

The **Million Book Project** was initiated by National Science Foundation, USA at Carnegie Mellon University. **The other partners in the project are India and China. The Million Book Project aims to digitise a large body of published literature**, which exists in the public domain or which is copyrighted but out of print, and **offer it free on world wide web**. The Indian Institute of Sciences, Bangalore is the focal point of this activity in India. Scanning of the the books, using OCR is being done and more than 400,000 books have been scanned till now. The material being digitised includes rare collections in chinese libraries, government textbooks in eleven official indian languages, US government documents and US copyrighted works and out of copyright works. The books will be mirrored at sites in India, China, Carnegie Mellon, the Internet Archive, and possibly other locations. Significant research is underway in the project, including machine translations and OCR for Indian languages and scripts. The research also includes developments in image processing, large-scale database management, and strategies for acquiring copyright permission at an affordable cost. Future developments will enable the Million Book Collection to be indexed by popular Internet search engines like Google and harvested via the OAI protocol.

Other projects

American Heritage Virtual Archive Project is collaborative project between the University of California—Berkeley, Stanford University, Duke University, and the University of Virginia. It aims to provide access to collections documenting American history and culture.

NSDL (<http://nsdl.org/>) was established by the National Science Foundation (NSF) in 2000 as a free online library to provide organised access to high quality resources and tools that support innovations in teaching and learning at all levels of science, technology, engineering, and mathematics education.

Historical Text Archive (<http://historicaltextarchive.com/>) provides access to quality articles, books, essays, documents, historical photos, and links on a broad range of historical subjects.

The Cornell University Library Windows on the Past (<http://historical.library.cornell.edu/>) provides access to a collection of selected historical materials which have been digitally scanned and are available for on-line browsing and searching.

Future Prospects

Large scale digitisation projects are being taken up at different institutions and organisations all over the world. Projects at Google, the Million Book Project, MSN, and Yahoo are a few examples. Digital libraries are rapidly growing in popularity with continued improvements being made in book handling and presentation technologies. Many alternative repositories and business models are being incorporated in the digital library structure. 'Internet libraries' such as the Internet Archive (<http://www.archive.org/>) have emerged. Internet Archive is dedicated to maintaining an archive of the Internet Their collections include "snapshots of the World Wide Web" (archived copies of pages, taken at various points in time), movies, audio recordings, books, and software. Google through its Google Print (<http://print.google.com/>) programme aims to organise public domain works and provide them online. Print Library Project is a part of the programme which involves scanning, digitising and making searchable parts or all of the collections from Stanford University, Harvard

University, Oxford University, the University of Michigan and The New York Public Library. Similarly, Yahoo in collaboration with Internet Archive has launched a programme called the Open Content Alliance which aims to build a free archive of digital text and multimedia.

15.6 MAJOR PROJECTS IN INDIA

India's Digitisation Initiatives

In India significant initiatives of digitisation are being taken up by the Government of India and other important institutions and major libraries. Digitisation programmes have been started. Digital libraries are being set up by important institution such as Indian Institute of Technologies at Delhi, Kharagpur, The Energy Research Institute, New Delhi, National Institute of Technology, Calicut (Nalanda- Network of automated Library and Archives), Indira Gandhi National Centre for the Arts (IGNCA), DRTC etc. In addition to this host websites and portals on different areas of research are being set up. Consortiums like Indian National Digital Library in Engineering Sciences and Technology (INDEST) are being formed. Some of the digitisation initiatives in India are:

- National Mission for Manuscripts programme was launched by the Department of Culture, India in 2003. India is the largest repository of manuscript wealth in the world which needs to be preserved and provided access to. The mission aims to locate, catalogue and preserve India's manuscripts and also to enhance access, spread awareness and encourage their use for educational and research purposes. Guidelines regarding the digitization process starting with the selection process and includes all technical issues, quality control, collection management, organization of images, output specifications etc. have been provided by the National Informatics Centre, India.
- Digital Library of India aims to provide access to free-to-read, searchable collection of one million books, predominantly in Indian languages, available to everyone over the Internet. Portal provides a gateway to Indian Digital Libraries in science, arts, culture, music, movies, traditional medicine, palm leaves and many more. This project is a collaboration between different Indian institutes and Universities and Carnegie Mellon University under Universal Digital Library Project. The project aims to provide support for full text indexing and searching based on OCR (optical character recognition) technologies so that the users can locate relevant information quickly through online search facility.
- Traditional Knowledge Digital Library (TKDL) is a collaborative project between NISCAIR (erstwhile NISCOM) and Department of Indian System of Medicine and Homoeopathy (ISM&H), Ministry of Health and Family Welfare. The project TKDL proposes to document the knowledge available in public domain on traditional knowledge from the existing literature covering Ayurveda, in digitised format in five international languages which are English, German, French, Japanese and Spanish. India created its library after fighting a successful legal battle in 1999 to revoke US patents for turmeric and basmati. The project aims to give legitimacy to the existing traditional knowledge and enable protection of such information. Now the South Asian countries have also decided to create a digital library of the region's traditional knowledge and develop laws to prevent such knowledge being misappropriated through commercial patents. India's TKDL will be used as a model by other South Asian nations. The aim is to create a composite digital library comprising individual Traditional Knowledge Digital Libraries (TKDL) from each country in South Asia. Accessible using the Internet, the library will contain information on traditional medicine, foodstuffs, architecture and culture.

- Indira Gandhi National Centre for the Arts [IGNCA] Digital Library contains digital images, audio and video recordings, animations, electronic books, etc., related to Indian arts and culture. Kalasampada: Digital Library- Resource for Indian Cultural Heritage (DL-RICH) is a project under IGNCA which aims to develop a digital repository of content and information with a user-friendly interface to enable the students, scholars, artists, researchers to access and view the materials including lakhs of manuscripts, slides, and rare books, photographs, audio and video, publications of IGNCA. CoIL-Net – Content development in Indian Language Network is another project that aims to enhance the access to cultural resources using digital technology by implementing user friendly, Hindi based, web enabled heritage library.
- Vidyanidhi - Digital Library and E-Scholarship Portal began as a pilot project under the University of Mysore in the year 2000 with support from NISSAT, DSIR, Govt. of India. The project aims to develop a repository for Indian doctoral theses, and digitise, archive and improve access to doctoral theses in India. Projects for digitisation of theses and dissertations have also been taken up by the Indian Institute of Technology, Delhi and Mumbai, and Physical Research Laboratory, Ahmedabad.
- The National Library of India is carrying out digitisation of rare books and brittle documents such as East India Co. records, diaries, etc., and manuscripts on paper and palm leaves. English books and documents published before 1900 and Indian publications of pre 1920 are considered for digitisation. So far 6,600 selected books in Indian and English languages have already been scanned and stored on 548 CDs.
- The Central Secretariat Library under the Department of Culture has undertaken the digitisation of the various government publications such as the Annual Reports, Commission and Committee Reports of the Central Government of India and Gazettes of India.
- The Parliament Library has digitized all records such as debates, questions, Committee Reports, bio-data of present and past Members of Parliament.
- The Khuda Baksh Oriental Public Library has initiated digitisation of Arabic and Persian manuscripts of medieval India.

In Indian scenario the digitization programmes are in their initial stages and much needs to be done to prepare a long term strategy to sustain these efforts and preserve the digital resources for future use. There is a need for a proper policy framework and on technology front there are problems like lack of multiple Indian language OCR facilities, lack of standards etc. which need to be addressed.

15.7 SUMMARY

In this unit we discussed about microfilming and how after Second World War it came to be used for preservation of records, documents, archives and collections. We also studied the different microfilm formats in use e.g., roll microfilm, unitised microfilm, aperture card, jacket, microfiche, ultrafiche, micro-card, micro-print, etc. According to the emulsion type, Silver, Diazo, vesicular and colour microfilms are used. Silver halide film is most suitable for archival use and can last more than 500 years if it is manufactured, processed, and stored properly. We also discussed the various advantages and disadvantages of microfilm. Microfilm offers advantages like long-term stability, less storage space, cost benefit, option to digitise. However, one of the major disadvantage of the microfilms is the difficulty of use. The emergence of new technologies in the 1990's opened up the possibility

of converting and storing data in digital form. British Library's Electronic Beowulf Project is one of the earliest initiatives taken in this direction. In this Unit we also learnt about the digitisation of the text, images, audio and video material available in the libraries. Digitisation has led to the development of digital libraries. A large number of digitisation and digital library initiatives are being taken up by libraries and academic institutions in India and abroad. We discussed some of the major projects like the Project Gutenberg, National Digital Library Programme of the Library of Congress etc. In India also significant projects and programmes have been taken up. The potential benefits of digitisation are easy access and availability, ease of use, flexibility, enhanced capabilities for analysis and manipulation. There is predominance of efforts for digitising existing collection of books, manuscripts, photographs and other materials. However, the creation and subsequent maintenance of electronic resources requires funding, skill, and ongoing commitment. We also addressed the issue of digitisation for preservation and how the technology for digitisation being in the developmental stage the question of preservation of digital resources themselves remains to be answered.

15.8 ANSWERS TO SELF CHECK EXERCISES

- 1) Different forms of microfilms in use are:
 - i) Roll microfilm: In this images are arranged in a linear fashion and roll microfilms are available in widths of 16 mm, 35mm, 75 mm, 105mm,
 - ii) Unitised Microfilm: This is a roll microfilm split into small lengths.
 - iii) Aperture card: Aperture card is a 7"x3" size opaque thick card having an aperture at the right hand side for mounting a 35 mm film frame. Aperture cards are usually found in engineering and geography related departments.
 - iv) Jacket: Jackets are made of polyester sheets to keep strips of micro film they are usually of 105 x 148 mm in size and channels for keeping 16mm/35 mm film. The heading area of the jacket provides information in a eye-legible form regarding the content of strips in the jackets.
 - v) Microfiche: Microfiche consist of a number of rows of reduced images of documents produced on a transparent sheet a film.
 - vi) Ultrafiche: Ultrafiches are similar to microfiches, but they have a significantly large number of frames than microfiche. Here the original is reduced over 100 times and hence a small scratch can impair legibility of a number of frames.
 - vii) Micro-Card: This is an opaque card of 3"x5" size in which reduced images are arranged in a number of rows.
 - viii) Micro-Print: It is larger than micro-card having a size of 6"x9".
 - ix) Microlex: The microlex cards are opaque having a 6.5"x8.5" size. The images are produced by photographic process and contains 200 pages on one side.
- 2) Factors that need to be considered while selecting material for microfilming are:
 - a) Conditioning of the document
 - b) Rarity of the document
 - c) Frequency of use
 - d) Volume of space occupied
 - e) Monetary, aesthetic and historical value associated with the document

- f) Maintaining the integrity of the document

In this technique first a scanner is used to produce a digital image of the text, then OCR software makes use of stored knowledge about the shapes of individual characters to convert the digital image into. OCR software allows the option of maintaining text and graphics in their original layout as well as plain ASCII and word processing formats. Some of the commonly used OCR softwares are Caere's Omnipage and Xerox Textbridge, ABBYY Fine reader.

- 3) Major advantages of digitisation are:

- i) Easy Access
- ii) Easy duplication
- iii) Automation
- iv) Ease of Search and Retrieval
- v) Less Storage Space Requirement
- vi) Image Enhancement
- vii) Ease of use
- viii) Purposeful Collaborations

15.9 KEYWORDS

Aperture Card	:	A micro-transparent document mounted on opaque card of 7" x 3" size.
Archival Microfilm	:	A film having the information bearing characteristics retainable for indefinite period
Jacket	:	A polyester flap of size 105 x 148 mm having channels of 16 mm/35 mm size for keeping microfilm strips.
Micro-opaque	:	The microform through which light cannot pass through.
Micro-transparency	:	The microform through which light can be transmitted.
Microcard	:	An opaque microform of size 3"x5".
Microfiche	:	A transparent microform, usually of size 105 mm x 148 mm having rows of reduced images.
Microlex	:	An opaque card of 6.5"x8.5" size capable of storing about 200 reduced images on one side.
Microprint	:	An opaque card larger than microcard having a size of 6"x9" and consists of 100 images with an eye legible bibliographic entry.
Roll Microfilm	:	The commonly used microform, available in 16mm, 35mm, 70mm and 105mm sizes. These are usually rolled in spools, cassettes and cartridges and hence the nomenclature.
Ultrafiche	:	A transparent film of Microfiche size having significantly high number of frames and the original is reduced more than 100 times.

- Unitised Microfilm** : Roll microfilm cut into small lengths for easy search. Usually unitised microfilms are in strips having 6 frames.
- E-Zine** : “zine” is short for either “fanzine” or “magazine,” Zines are generally produced by one person or a small group of people and are not targeted towards a mass audience, and are generally not produced to make a profit. An “e-zine” is a zine that is distributed partially or solely on electronic networks like the Internet.

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