UNIT 1 NEED FOR PRESERVATION AND CONSERVATION

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1.0 OBJECTIVES

After reading this Unit, you will be able to:

- know the concept of preservation and conservation and the role of the librarian in doing so;
- plan the steps required for preservation of various library materials;

- understand the methods used for effective preservation in a library; and
- get a clear insight into the techniques of conservation or restoration of book materials.

1.1 INTRODUCTION

This first Unit of the course on "Preservation and Conservation of Library materials" is a general introduction to the subject. One of the very important aspects of a Librarian's obligation to the society is the preservation of the collection '.'of reading materials in his, custody in a good, healthy and usable condition. To enable him to fulfill this basic responsibility with the required competence, he has to have an adequate knowledge of the 'whys' and 'hows' of preservation and conservation. This Unit explains the concept and its various implications. It also gives a general outline of "the various preservation and conservation methods and techniques to create a general background for a more elaborate study in the subsequent Units.

1.2 CONCEPT OF PRESERVATION AND CONSERVATION

1.2.1 Meaning of the Terms

In common parlance, the words 'Preservation' and 'Conservation' are often used interchangeably to mean: the process of keeping an object safe from harm or loss, damage, destruction or decay, and maintaining it in a reasonably sound condition for present and future use. But strictly speaking, these two words have different, though interrelated and overlapping connotations. 'Conservation' has three aspects:

1) **Examination :** To determine the nature/properties of materials and causes of deterioration and alteration.

2) **Preservation :** Adoption of appropriate prophylactic and prospective measures to maintain the specimen in as good a condition as possible, and to prolong its life to whatever extent possible.

3) **Restoration :** Appropriate remedial treatment of an already affected specimen.

Thus, 'Conservation' is an activity of which 'Preservation' is one aspect. In common practice 'Preservation' deals with the maintenance aspect and 'Conservation' with the remedial treatment and restoration of the already damaged specimen.

1.2.2 Shared Responsibility

Preservation and conservation together constitute a responsibility, to be shared by the Archaeologist and the Musicologist on the one hand and the Archivist and the Librarian on the other.

There are various types of media which have been used through centuries to store ideas and information. These media fall under the following broad categories:

i) Media made of 'inorganic' substance, such as, stone, burnt clay, metal plates etc.,

ii) Media made of 'organic' substance, such as, palm-leaf, birch-bark, wood, cotton, animal skins, papyrus, and silk, paper etc.

iii) Media created by modern technology, such as, cellulose material like films, vinyl recordings, polythene cassettes, digital recordings on tapes and floppies etc.

Generally, writing materials composed of organic substances have the tendency to deteriorate at a pace much faster than those made of inorganic substances. Broadly speaking, specimens composed of inorganic media, created centuries ago, and which are required to be conserved for centuries to come, fall within the ambit of Archaeology and Museology. The identification, preservation and restoration of such specimens constitute a distinct discipline. On the other hand, the responsibility concerning specimens composed of organic substances is shared by the Archivist and the Librarian, depending on the requirement of specific situations. This last point can be explained further.

Most of our Libraries, even the big ones, do not have a well-equipped Archival Section nor is it considered justified in most of the cases to have one. If in such a Library there is a rare volume, which continues to be useful to the clientele, but is damaged to an extent beyond the scope of routine in house treatment, the Librarian should do well to pass it on to the Archivist for necessary treatment. The Librarian should not venture to assume the responsibility of the Archivist at the risk of causing irreversible damage to the volume by improper or inadequate treatment.

Routine inhouse treatment of a minor nature, such as mending, pasting, rebinding etc. of the general type of material can be carried out by the library itself with some elementary knowledge of restoration techniques. But if the required treatment involves specialised technical expertise, and the specific situation so demands, the job should be left to the Archivist. In no case should the routine conservation treatment for the general collection of library be confused with the programme of conservation of rare and precious volumes, unique items, and other special types of materials.

There are yet other types of materials in our libraries today. These are the products of modern technology, such as, floppy diskettes, CD-ROMs, films, audio and video cassettes etc. These are media of recent origin. Their preservation falls within the domain of the Librarian's responsibility, and will continue to remain so in any foreseeable future.

1.2.3 Librarian's Responsibility

In so far as Librarians are concerned, they have the moral responsibility of preservation and conservation, vested in them. Books and other media in a Library preserve facts, thoughts, fantacies and accomplishments and in a word, the record of human civilisation. The past records constitute a natural resource, and are indispensable to the present generation, as well as to the generations to come. There is, therefore, a moral imperative to preserve the legacy. Our past reality and experiences expand the horizon of our future possibility.

The records which are being created and accumulated in our libraries *today* will turn as records of the *past* achievements *tomorrow*. If, therefore, today's librarians do not pay adequate attention to preservation, not only of the old documents but also of the current ones, of which they are the custodians, they will be answerable to the future generations for having failed in one of the most important responsibilities entrusted to them by the present Society.

Self Check Exercise

1) Discuss the concept of Preservation and Conservation.

2) Describe briefly the role of the librarian in the preservation and conservation of Library materials.

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

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

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1.3 GENERAL APPROACH TO PRESERVATION

When we talk of the preservation of a document in a library, be it a manuscript or a printed book, or in the form of a non-book item, we look at the three components which constitute it:

i) The artefact (the physical entity)

ii) The image (the impression on the artefact)

iii) The information (the thought content)

1.3.1 Preservation of the Artefact and Image

For the sake of convenience in this discussion let us use the generic term 'book' to include other reading materials also. A book is almost unusable if its pages are brittle and the brittle pages crack and crumble when turned, or its pages stick to each other and cannot be turned. It is also difficult to use if its binding is in a delicate, fragile state, incapable of holding the pages together.

There are the cases where the *artefact* is in an unhealthy state. Similarly, a book may be stained, and not clearly legible. If the photographs and illustrations are blurred, discoloured or stained, their usefulness is greatly diminished, and in extreme cases these become almost useless. Scratches on films and vinyl recordings reduce their usefulness to a great extent.

All these cases are the ones where the *image* is in a poor state. Deterioration of the artefact and the image is caused by the interplay of three basic factors:

i) The inherent characteristics of the materials of which the artefact is composed;

i) The storage condition of the artefact, and

iii) The type, intensity and amount of handling of the artefact by the clientele, and the Library staff.

Inherent Characteristics of the Library Materials

a) Palm-leaf and Birch-bark Manuscripts

Birch tree is of Himalayan Origin. Birch-bark sheets usually consist of a number of layers, collected from the inner side of the bark. These are thin and delicate sheets, containing some natural preservative chemicals (salt of salicylic acid), which are insect-repellent until this natural preservative dries up.

Palm-leaf, on the other hand, is of two varieties: *tala* (Palmyra) and *Sritala* (talipot). Leaves of *tala* are thick and coarse and are difficult to handle. These do not absorb ink, and, as such, characters have to be inscribed on them with a stylus on the surface and the

grooves filled with ink. The leaves of sritala, on the other hand, are thin, flexible and can be handled' or written on like paper.

Birch-bark and palm-leaf are natural organic materials. These possess inherent strength to withstand normal environmental effects for many years, even many centuries, if stored properly. But a normal and congenial environmental condition is difficult to maintain for these materials. Over a long period of time, the layers of birch-bark tend to separate and the edges of birch-bark and palm-leaf show a tendency of curling up, if exposed to prolonged dryness. Prolonged dampness also causes their gradual deterioration.

The hand-written texts on palm-leaf and birch-bark generally used black carbon ink or pigment, which have the quality of retaining legibility for centuries, if kept away from acidic contaminations. The preservation of these materials will be discussed in details in Unit 3 of this course.

b) Paper

Manuscripts, and mostly printed records on paper constitute by far the largest bulk of the collection of any library today. The futuristic view, forcefully propounded by some moderm scholars that the 'paperless society' is just round the corner, no doubt sounds exciting. Yet, we cannot visualise a stage when the number of paper-made items will stop growing in our library collections. In fact, the situation today is just the other way round. The rate of growth of paper-made documents all over the world has been accelerating at a tremendous pace. The small part of it that enters into our library collections everyday, for preservation and use, itself constitutes a huge bulk. The libraries cannot lay major emphasis on preservation and conservation of this category of items.

Paper is composed of organic fibres, chemically processed. These fibres lose their strength and deteriorate gradually through even the normal ageing process, Paper produced before mid-nineteenth century was of handmade variety, using alkaline chemicals for processing. The alkalinity of the paper and also the natural strength of long cotton fibres, which were commonly used, contributed toward greater strength and longevity of the handmade paper. But the mass-produced machine-made variety of paper marketed since mid-nineteenth century use mechanical wood pulp and acidic (instead of alkaline) chemicals for processing, for the sake of economy and speed of production. The wood fibres, produced by grinding, are much shorter and weaker, and all impurities and acid substances, such as lignin, are retained in the finished product. These bear the seed of the paper's disintegration at a much faster rate. Owing to its acidic content, the paper loses flexibility, splits, turns yellow and brittle in a much shorter time as compared to handmade paper. It is this acidic content again, which gradually affects the legibility of the image also.

The various qualities of paper, and their typical characteristics will be discussed in the next Unit, and their preservation and conservation in Unit 4 of this Course.

c) Binding

Another important component of the artefact is its binding. Materials used for binding, such as wooden boards wrapped in cloth for palm-leaf and birch-bark manuscripts, which is the traditionally used method, straw board and leather, rexine, thread and adhesive used for books are all organic materials, susceptible to ageing and deterioration.

In Library binding it is the leather that gives to it the major strength and durability. Leather, which is the middle layer of the animal skin, is of fibrous structure of collagen. This skin is converted into leather by the tanning process.

Good quality vegetable tanned leather is ordinarily a very stable substance, but in adverse circumstances it is liable to be attacked by insects and fungi. It contains waxy and greasy constituents which gradually volatilise in hot climate, and the leather often loses its flexibility in course of time.

The leather and rexine used for binding are not always of any prescribed standard. This is one aspect. The other aspect is concerned with poor or substandard workmanship. A loosely bound book fails more rapidly in use as pages separate from the binding. On the other hand, too tight binding encourages the reader or the photocopier to damage the bookspine by ruthless handling. If the binding thread is weak, it is likely to break.

d) Other products:

The collection of documents in the form of film, film strip, microfilm and microfiche is growing in many of our libraries.

Film material produced about half a century ago had cellulose nitrate as the ingredient. This material decomposed fast even in normal atmospheric conditions; and in the process of decomposition, if tightly stored, these had the tendency to burst into flames.

Cellulose acetate film, which replaced nitrate films in the late 1930's also deteriorate, shrink and gradually get separated from the emulsion coating on the surface on which the image is printed. But this process of deterioration is slow. The polyester films, now available since 1960's appear to have better prospect for longevity. But it is too early to say anything in this respect quite conclusively at this stage.

As regards the emulsion, the silver gelatin coating of well tested standard lasts for a long time, but are susceptible to scratches. There are varieties of non-silver film. which have been found considerably more durable under frequent use than silver films, but the images on such films fade from prolonged exposures to heat and light.

This basic idea about the physical composition of the, film material in the collection will enable the librarian to take appropriate steps for their proper storing and preservation.

Apart from films, there are various other items created by modern technology, which are gradually entering into the libraries today. The question of proper handling, maintenance and preservation of such items will be discussed in Units 5 of this course.

Storage Condition of the Artefact:

To prolong the artefacts life, it is essential to ensure avoidance of certain adverse environmental conditions. Some of these, along with the adverse effects created by them are listed below.

	Adverse environmental conditions	**Nature of deterioration caused to artefacts**
(i)	Too frequent changes in temperature and relative humidity	To all organic material which constitute the artefact, this condition causes: - loss of flexibility - fragility - reduction of longevity

(ii) Prolonged exposure to damp and warm climate (a serious problem in tropical countries like India)	a) Causes formation *of* mildew or fluffy moulds, which creates brownish or greenish black patches on leather, paper etc. (foxing), b) Cause foxing and weakening of the sizing material used ort paper surface. c) Birch bark and thin sheets of paper, particularly art paper, which has loading on the surface, stick together" d) Damp walls in warm humid climate help growth of insect pests like Silver fish, book-worms and book lice etc., which feed on record materials and cause serious damage to the artefact and image.
(iii) Atmosphere pollution (Oxides of carbon, sulphur and nitrogen, sulphurated hydrogen etc. particularly serious in urban areas)	The polluted atmosphere containing acidic gases results in paper turning yellow, brittle and charred to an extent ultimately reduced to dust. These pollutants damage the binding and cause fading of the image
(iv) Long exposure to strong light, especially sun light containing ultraviolet radiations	Causes deterioration of paper, binding, film material, and fading of the image, particularly if it is composed of assorted colours.
(v) Dust containing hard silicious and carbonacious matter	Dust particles cut into delicate paper fibres by an abrasive cutting action, thus reducing the strength of paper. provide nuclei for condensation of acidic ases are unhygenic, may contain bacteria and ause allergy to those who handle the material.

The above table, though not exhaustive, indicates the need to eliminate serious adverse environmental conditions, as far as possible, to ensure health and longevity of the artefact and image. .

Handling of the Artefact

Ranganathan's First Law of library science says: "Books are for use". This law, read in the context of what has been said above, will make -you realise that *dissemination* of library materials and their proper *preservation* should go hand in hand. These two represent two basic priorities, which, however, are at odds with each other. If the objective of our preservation programme is to maintain the artefact in a proper healthy condition for a long period of time, we should ensure that it is not subjected to rough and too much of handling. It is the common experience of Librarian that a book, even if in a very delicate state, will remain as it is for many years, if not disturbed too often. We have to reconcile these two conflicting priorities. We have to realise that preservation without use is pointless, and use without preservation is disastrous in the long run.

This conflict leads naturally to two types of library collections: one is primarily to preserve the material and the other (by far the majority) for use. A judicious separation of these two types of materials is essential.

To decide whether a particular artefact should be preserved, the following questions have to be answered:

i) Is preservation the cheapest and fastest way to preserve the content?

ii) Will preservation of the artefact aid future scholars?

iii) Will the failure to preserve reduce the value of the content?

Unfortunately, there are no easy ways to answer these questions precisely. It is a problem which the Librarian has to face and solve with competence.

1.3.2 Preservation of Information

Our preservation effort is most successful if we can maintain the *artefact*, the *image*, and the *information*, i.e., all the three components which compose the document.

In certain cases, the artefact alone has its own value. It is, of course, a different sort of value than that of the information contained in it. For example; the seminal contents of most of the *'illuminated manuscripts'* and the *incunabulae* of the ancient past, have been reproduced many times in some form or the other. Yet, the original artefacts are precious specimens of art and history even today.

These are preserved in Libraries and Museums with extreme care. These have to be preserved at all cost. In such cases the artefact and the image in their original forms are more important than their information content.

In fact, every rare volume has some value, at least to some, as an artefact, and the effort to preserve such books is considered as a very sensible effort.

If preservation of the artefact in its totality is not feasible on economic and other practical considerations, the next best effort is to preserve the image by resorting to appropriate modern technology, such as, facsimile reproduction, or microfilming. The lowest level of preservation is concerned with mere retention of the information contained in the book. This is considered adequate to the vast majority of users who see books as nothing more than vehicles of transmission of information. To them, if the information is available in machine readable form (where the artefact and the image vanish from the scene altogether) they see this level of preservation as ideal.

Self Check Exercise

3) What are the components which constitute a document, important for preservation in a Library?

4) Enumerate the adverse environmental conditions and the nature of deterioration caused by these conditions to the artefacts.

5) How is the first law Of Library Science "Books are for use" related to the idea of preservation and conservation?

6) "Preservation of information contained in a book is more important than the book itself". Elucidate the statement.

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

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

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1.4 PRESERVATION MEASURES

The delicate nature and the susceptibility to deterioration of library materials have been briefly described in the preceding paragraphs. That will serve as a guide to our preservation approach, both prophylactic and prospective. The preservation process will be discussed in details in the subsequent Units. Here only a general outline is given:

1.4.1 Storage Environment

For long term preservation of documents, the selection of proper storing space is essential. The Library stack-area should have the following:

i) Adequate ventilation - If necessary the area should be provided with air-circulation devices like, adequate number of exhaust fans. Air circulation helps removal of stagnant air pockets, which, coupled with excessive humidity, helps growth of micro organisms and injurious pests.

ii) The orientation of windows should be such that these regulate sunlight and reduce the injurious effects of the outside climatic conditions. .

iii) In no case should the stack area be on the basement floor of a building where the floor and the walls are likely to be damp or subject to flooding, particularly in the rainy seasons, or due to choked drains.

iv) Entry of rats into the area should be prevented by sealing all joints in the partition walls, and covering the drain outlets. Hygienic conditions should be maintained in and around the stack area..

v) To avoid white-ant menace, the building should be isolated by digging a trench outside the foundation wall and filling it with chemicals like coal tar and creosote ail. It is always better to take the help *of* a professional pest-control organisation to provide a thorough treatment by using Aldrex or other suitable chemicals, to prevent entry of the queen-ant which can produce 30,000 eggs in a day. Such a treatment will provide an insect-barrier lasting far 5-6 years at a stretch. The foundation of all new buildings should be given anti treatment.

vi) The area should have a properly done-up floor and walls, so that these do not throw dust all the time.

vii) Protection against Fire Smoking, use of heaters and storage of inflammable liquids in the storage areas should be prohibited. All electric wiring should be through conduit

pipes. Electric wiring should be regularly checked to guard against weakening insulation. The use of temporary lights, power connections and over-loading of electric circuits should be avoided. Proper fuses, circuit breakers and earthing should be provided. As a precautionary measure all light and power circuits should be switched off after office hours. Fire detection alarm system as also suitable fire extinguishers should be provided in the storage area. A reference to Indian Standard IS: 11460 - 1991 "Code of Practice for fire safety of libraries and archives buildings" will be helpful in this context.

1.4.2 Atmospheric Condition

Adverse environmental conditions, listed in the table at above paragraph "Storage Condition of the Artefact" require to be eliminated as far as possible.

Temperature between 22°- 25° C and relative humidity between 45% - 55% constitute the most suitable ambient condition far storing of library materials. This can be achieved only by air conditioning. But this facility is not available to most of our libraries. Maintenance of cool, dry atmosphere and avoidance of too frequent changes in temperature and humidity in the stack area should be achieved as far as possible by other methods.

1.4.3 Dehumidification

In the absence of air conditioning facility, to minimise the humid condition and dampness, especially during the rainy season, suitable dehydrating agents like anhydrous calcium chloride and silica gel can be used. Silica gel in requisite quantity (2-3 Kgs for a room of 20-25 Cu.mts. capacity) may be put in small dishes and the dishes kept in different locations in the room. When the silica gel gets saturated with moisture, it has to be replaced. Commercial dehumidifiers are also available. These can be used where the stack area is large.

1.4.4 Deacidification

The wooden boards and cloth used in wrapping manuscripts in bundles, the leather, cord and end-papers used for binding should be acid free to avoid transmigratory acid contamination of the document.

As has been stated earlier, the acid residue in paper at the manufacturing stage causes its deterioration at a rapid pace. To neutralise this acid content, various methods of deacidification have been and are being tried. Some of the-more common processes are Morpholine Process (Barrow's) Vapour Phase Deacidification, wet TO Process, Diethyl Zinc Process. These chemicals are hazardous in nature and also require installation of costly equipment. Less hazardous and cheaper methods of deacidification involve the use of spray deacidification, ammonia gas deacidification and aqueous deacidification (solution of calcium hydroxide and calcium bicarbonate) depending upon the nature of the writing ink used and the strength of the paper.

In each one of these processes there are advantages and disadvantages. Deacidification or treatment of individual items by any of these processes will slow or retard further damage to the material due to acidity. Treatment of only very selected precious items, can be considered because of the considerable cost involved in deacidification.

1.4.5 Preservation of Special Types of Materials

i) Palm-leaf and Birch-bark Manuscripts

The traditional practice of storing manuscripts is to collect several sheets together and tie them in between two thin wooden boards. The bundle is wrapped in pieces of cloth to protect against dust and other surface feeders. In this traditional method there is the possibility of uneven pressure on the sheets while tying each time. If the sheets have already - turned brittle, there is the risk of cracking. Therefore, proper - care is necessary in tying and untying the bundles.

The best method of storing manuscripts is to keep the leaves loose in wooden or cardboard boxes, the size of which is slightly bigger than that of the leaves, so that these can be taken out and replaced with ease. Too frequent and careless handling should be avoided.

Since manuscripts are likely to be very sparingly used, it is necessary that once a year the bundles are opened, the sheets separated and cleaned and carefully stored again.

ii) Films

Apart from storing the films in boxes, microfilms in cases and microfiches in separate envelopes, and these materials in a cool, dry and pollution free environment, it is necessary that the films, if not in use for long, are run at normal speed, at least once a year. This is necessary to eliminate the possibility of layers of film sticking together.

iii) Binding

Unlike paper and other materials, in the creation of which the librarian has very little control, binding, with a few exceptions, is the creation of the librarian itself. He/ she has to ensure that the binding has been done with standard materials and the binder has adopted standard processes. Indian Standard IS: 3050-1962: Code of practice, for reinforced binding of Library books and periodicals will provide adequate guidance in this regard.

Superficial dust particles and prolonged exposure to damp warm climate affect durability of leather. There are a number of compounds used as protective coating as leather preservative dressing. One such formulation found quite effective, is a mixture of: lanolin anhydrous, bees wax, cedarwood oil and benzene. This composition acts as a buffer solution , for longterm preservation of leather bound books.

1.4.6 Pest Control Measures

A simple practice is to keep naphthalene bricks every six or eight feet on the shelves. This is an effective insect-repellent measure. A mixture of paradichlorobenzene and creosote, kept in dishes in the stack room also acts as a good insect-repellent. 10% solution of thymol in methylated spirit sprayed in the stack room from time to time will check the growth of spores. But, for bigger collection it is always advisable to seek the services of a professional pest control organisation for routine treatment under service contract agreement.

1.4.7 Vigilance and Cleanliness

Two most important steps which every Library should meticulously follow are:

- To keep constant vigilance in the stack area, particularly the dark corners. This will help eliminate the possibility of the growth of micro-organisms and other insect attacks.

- To maintain utmost cleanliness and tidy conditions through a process of regular dusting. While dusting, care should be taken to ensure that the dust particles are not thrown about and do not settle down elsewhere in the shelves. The ideal method is to do the job with the help of a vacuum cleaner.

Self Check Exercise

7) Explain how preservation measures can help to keep the library materials intact and legible for years together.

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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1.5 PRESERVATION CHALLENGE IN DEVELOPING COUNTRIES

One factor that is common to most of the developing countries in Asia, Africa and Latin America, is the warm and humid climate. This common characteristic of Tropical and sub-Tropical regions takes upon itself the destruction of all library materials more aggressively than in the temperate regions of Europe and North America.

Heat, humidity, dust and other atmospheric pollutants enhance paper embrittlement, quicken the ageing process of all Library materials, and cause moulds and various insect pests which are detrimental to flourish at a rapid rate.

The climatic changes in Tropical and Sub-Tropical regions are too sharp and too frequent to control without air-conditioning facility. For lack of resources this facility is beyond the reach of most of the libraries in the developing countries. And again, it is the economic factor which creates an insurmountable handicap to the adoption of deacidification, dehumidification and other preventive measures on a mass scale, even though these have been found to be quite effective in developed countries.

In a country like India, the adverse conditions are too severe, the enemies are too numerous, but the available resources are too little. Under the circumstances, the preservation challenge faced by the Librarians is more serious than in the developed countries.

We cannot afford to remain as silent spectators to watch the precious collections deteriorate gradually beyond repair. We should ensure that the storage conditions are as good as possible, and should maintain the collections in our custody in an environment as congenial as possible, so that the life of our collections is prolonged.

1.6 CONSERVATION: RESTORATION

Conservation is primarily concerned with the remedial treatments of already damaged or affected materials. In the following paragraphs a brief outline of a few methods, which a

Librarian can adopt as a part of his/ her regular activity, is given: Those methods and techniques, which require the special expertise of the Archivist, have been left out.

Conservation and restoration techniques are under constant review and revision. The conservators are not always unanimous about the efficacy and safety of certain methods, and certain chemicals used. The developments in this area are continuous. A Librarian should keep himself aware of these developments.

1.6.1 Flattening of Creases and Wrinkles

Often there are creases in certain pages of book. Sometimes the edges of the page show wrinkles. These may cause the affected portion of the page to eventually split. Such creases and wrinkles should be flattened, whenever noticed, before it is too late. The page to be flattened should be moistened with a wet sponge, and the damp page covered with blotting paper, or waxed paper on both sides (to avoid damp pages sticking together). It is then pressed with a cold, or if required, a moderately heated iron.

1.6.2 Repair of Minor Tears

This can be done by pasting strips of thin paper of good quality at the back of the torn portion. If there are writings on both sides, mending should be done by pasting strips of transparent, thin tissue paper on both sides of the tear.

Use of ordinary gum or glue should be avoided because these materials shrink on drying. Freshly prepared binders' paste (wheat, flour and 2-3% Formalin) is quite satisfactory. If, however, transparent tissue paper is used, Dextrine Paste or of Sodium Salt of Carboxymethyl Cellulose (CMC) paste should be used to maintain legibility of the writings. This adhesive is used for repair with tissue paper.

1.6.3 Treatment of Fragile Paper

If a document has become fragile, and its intrinsic value demands proper reinforcement, it can be done by the following methods:

i) *Tissue repair:* Full pasting of fine quality tissue (Japanese paper)

ii) *Chiffon repair:* Using fine transparent silk gauge, and

iii) *Lamination:* Using cellulose acetate file and tissue paper with solvent or heat method.

The first two processes can be carried out in the Library with the help of trained hands, but the last one, i.e., lamination, requires special equipment, which is available only in selected archives. Chiffon repair is very suitable for palm leaf and birch bark manuscripts.

1.6.4 Removal of Stains

Books and documents sometimes get stained because of various reasons. There are various methods of removal of such stains, as is tabulated below. But 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, cause fading of the image and other irreversible injuries to the artefact. Stain removal should not be attempted without expert guidance. Details are given in Unit-14.

1.6.5 Fumigation

If the books are infested by insects, bacteria, moulds and fungus, the infestation can be eliminated by fumigation process. The infested materials are separated from the collection

and treated promptly. Before replacing the fumigated books on the shelves, the area where the infestation had occurred, should be disinfected thoroughly.

Thymol or Paradichlorobenzene fumigation process h simple, effective, and can be easily managed in any library. Fumigation with thymol eliminates mildew or moulds while use of paradichlorobenzene or fumigation kills book worms, silver fish and cockroaches.

Thymol fumigation is done in an air-tight wooden chamber. Books and documents meant for fumigation are kept in inverted V form and on a framework covered with wire mesh at a height of two feet from" the bottom of the chamber. A 40 watt electric bulb is installed at the base of the chamber under a circular opening and over that a disc containing thymol crystals is placed. A dose of 150 gms of thymol per cubic meter is required while the cycle of fumigation varies from 6 to 8 days. .

Fumigation in the paradiehlorobenzene is done in an air-tight steel vault or almirah containing adjustable, perforated shelves for keeping' infested documents. A dose of 1.5 kgms of fumigation is continued for 7 to 8 days.

Instead of paradicholorobenzene, Killoptera –a mixture of ethylene dichloride and carbon tetrachloride (3:1) can also be used for fumigation. A dose of 225 gms/cubic meter of this mixture is required with a fumigation cycle of 24-36 hours. These chemicals vapourise at room temperature and their vapours are heavier than air. They are, therefore, kept in the upper most shelf of the fumigation vault.

Other fumigation methods, consist of the use of vacuum fumigation process and a thermostatically controlled air tight vault which can be used effectively for sterilising all types of biological infestation..

Self Check Exercise

8) Discuss the nature of stains and their removal from the documents.

9) Describe briefly the process of fumigation in the conservation of documents.

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

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

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1.7 SUMMARY

In this Unit, you have studied the basic points about preservation and conservation. Preservation on one hand deals with maintenance aspects and on the other side conservation deals with the restoration process. The role of the librarian has been mentioned in respect of preservation and conservation. Preservation involves a great deal of planning even from the beginning of the library foundation. Various methods used for effective

preservation of different types of library materials have been discussed. Atmospheric condition in the library, pest control measures, and regular vigilance and cleanliness are the other important factors described in the Unit. Different techniques, of conservation or restoration of library materials have been discussed. Another point that has been mentioned is the use of latest techniques and methods in this area of real concern so as to have the library materials intact and legible for reading.

1.8 ANSWERS TO SELF CHECK EXERCISES

1) Preservation and conservation of library materials are meant for upkeep of materials for future use. Preservation deals with the regular maintenance aspect, whereas conservation with the remedial treatment and restoration of the already damaged specimen.

2) Though the identification, preservation and restoration of documents constitute a distinct discipline shared by archaeologist and museologist, the librarian's role in a library too demands preservation and conservation of documents so as to make them available for generations to come. Librarian must pay attention for regular maintenance, atmospheric condition and pest control in the library. The upkeep of fire fighting equipment and restoration of old documents using fumigation and other techniques must be known to the librarian.

3) A document constitutes three components important, for preservation:

   i) The artefact the physical entity of the document i.e., its pages, binding etc. One has to check, the conditions of these, whether the pages are brittle, stick to each other, crack and crumble when turned; binding is delicate, fragile state and or incapable of holding the pages together.

   ii) The image - the impression on the artefact i.e., writing or printing on its pages. One has to check the condition of pages, whether pages have faded or stained, not clearly legible, photographs and illustrations blurred, discoloured etc.

   iii) The information,- the thought content of the document, in case it is not feasible to preserve the artefact, then the next best effort is to preserve the thought content of the document by using appropriate modern technology such as facsimile reproduction, microfiliming etc.

4) Some of the adverse environmental conditions and nature of deterioration caused by them to the artefacts are as follows:

	Adverse environmental conditions	*Nature of deterioration caused to artefacts*
i)	Too frequent changes in temperature and relative humidity	Loss of flexibility, fragility and reduction of longevity.
ii)	Exposure to damp and warm Climate	Patches, on documents, growth of insects which feed on records
iii)	Atmospheric pollutants	Pages turned yellow and brittle, and fungus on the artefacts.
iv)	Long exposure to strong light	Causes deterioration of paper, film material and fading of the image

5) "Books are for use" Ranganathan's first Law of Library Science emphasises on the dissemination of library materials. Proper dissemination of library materials is possible if the documents are in good condition. This demands the proper preservation and conservation of library materials so that the librarian can maintain continuous demand or use. On the other hand while doing preservation and conservation one must keep the economic aspects in mind. One should preserve and conserve those materials which are in use and having scholarly value for future uses.

6) Information is one of the components of a document. There are documents having high value as an artefact rather than the document as a whole. Such documents are precious specimens of art and history, and should be preserved with extreme care. In such cases; the artefact and the image in their original forms are more important than their information content. But for scholar who considered books as nothing more than vehicles of transmission of information, to them information is more important than the book itself. If the information is-available in the form of microfilm or machine readable form to the generations to come then this level of preservation seems to be ideal.

7) On applying the following preservation) measures' the librarian can keep the library materials intact and legible for years together.

   i) Storage environment: Adequate ventilation and orientation of windows so as to regulate sunlight reduces the injurious effects of climatic conditions. Smoking, use of heaters should be prohibited in the storage space. Proper electric wiring and sufficient fire fighting facility must be provided in the library.

   ii) Atmospheric condition: Proper air-conditioning in the library helps to maintain the atmospheric condition. Temperature between 22 - 25° C and relative humidity between 45% - 55% constitutes the most suitable ambient condition for storing of library materials.

   iii) Pest control measures: Insect - repellent and regular chemical spray in the library helps to maintain an insect-free library.

   iv) Regular vigilance and cleanliness: To keep regular vigilance in the stack area and to, maintain utmost cleanliness help to strengthen the ideal place for reading and writing for users.

8) Documents in the library sometimes get stained due to various reasons. There are different methods of removal of such stains depending on the nature of the stain. Stains caused by water fingers and crease and tar can be removed by calcium hypochloride and carbon tetrachloride respectively. Insect stain and tea and coffee, can be cleared by using hydrogen peroxide with alcohol, and 2% solution of potassium perborate respectively. Ink stain can easily be removed by applying citric acid in water. Before applying any of the above chemicals, it is necessary to try on a very small portion of the affected area.

9) Process of fumigation helps to restore the, documents infested by insects, bacteria, moulds and fungus. At first the infested materials are separated from the collection and treated immediately, the area where the infestation had occurred should also be disinfected thoroughly. The infested collection is kept in a fumigation chamber in inverted 'V' shape on the platform. Fumigation in thymol crystals or Para dichlorobenzene is done, while the cycle of fumigation varies from 6 to 8 days. Other fumigation methods, consist of the use of vacuum fumigation process and a thermostatically controlled air tight, chamber which can be used effectively for sterilising all types of biological infestation.

1.9 KEYWORDS

Art Paper : Smooth glossy paper, also known as coated paper. The base paper is coated on both sides with China clay and casein glue and then glazed under pressure between rollers.

Buffer Solution : Substances used for controlling the active and potentially harmful effects of chemical changes in materials.

Cellulose Acetate : 'Safety' film stock introduced around 1930. Does not burst into flame in normal environmental condition, but does shrink and separate from the emulsion (image).

Cellulose Nitrate : Film stock used prior to the introduction, of "safety" stock (see Cellulose acetate). It decomposes, and can spontaneously burst into flame.

Deacidification : Treatment of paper or other library materials to neutralize acidity in order to improve durability.

Diethyl Zinc : Agent used for mass deacidification. The process is being tested in the Library of Congress (USA). It yields good results, but there are handling problems, which have delayed large-scale use.

Manuscript

Digital : Consist of numbers and numeric representations, typically binary numbers. Nearly all computers use digital technique for storing and manipulating data.

Emulsion : A coating consisting of light-sensitive materials contained in a medium, used on a film base.

Facsimile : An exact copy of a document or illustration obtained by photomechanical processes.

Foxing : Brown-red stains found on paper. the origins of the marks are not yet fully understood, but they occur in books and documents stored in an uncared environment.

Fumigation : Gaseous treatment of materials to destroy micro-organisms and infestation by insects.

Fungus Spores : Destructive mildews flourishing in damp conditions. They appear in dull shades of green, gray, brown, blue and purple.

Illuminated : Many religious manuscripts and some of the others were ornamented in the early days by patterns and pictures done in gold paint and with brilliant blues and reds. These are known as illuminated manuscripts.

Imitation Art Paper : Unlike art paper, which is coated, imitation art paper is loaded, by adding clay and glue to the pulp.

Incunabula	:	Books printed in the 15th century AD., at the earliest stage of printing. These are the specimens of the cradle-period of printing and typographic art.
Lamination Paper	:	Protecting and strengthening paper by covering one or both sides with transparent tissue paper, and/or cellulose acetate foil using heat or acetone solvent.
Mechanical Wood	:	Cheap paper made by grinding raw wood into pulp (newsprint). All impurities and acid substances remain in the paper, causing its early deterioration.
Mildew	:	Destructive growth of minute fungi on paper, leather etc., exposed to warm, damp climate.
Microfiche	:	Sheets of film used to store text and still pictures as small images, requiring a reader for legibility. Most contemporary microfiches are 4"x 6" (105 mm x 148 mm). Photographic fiches contain 98 pages in 14 columns of 7 rows. Each image is 10 mm. × 12.5 mm or roughly 1/24th dimension of an 8.5 inches × 11 inches page. This is known as "24 × reduction. Fiches generated from computer files usually contain 270 pages or frames recorded at 48 × reduction.
Deacidification		
Microfilm	:	Photographic film used to store text and still images in greatly reduced form, intended for use with a special viewer or reader.
Morpholine	:	An organic amononia-based solvent used by Barrow Laboratories for mass deacidification.
Relative Humidity	:	The quantity of water vapour in the air relative to the temperature of the atmosphere.
Silk Chiffon	:	Finely woven silk. It is used for the repair of fragile papers, hardly discernible when pasted down.
Sizing	:	A gelatinous solution used in coating and glazing paper surface.
Tanning	:	The treatment of animal pelts to make leather using vegetables, minerals and animal fats.
Tissue	:	Fine quality paper, ideal for repair and restoration work.
Vapour Phase	:	An early method for deacidifying books by alkaline gases.
Waxed Paper	:	Paper impregnated or coated with wax. Used to interleave sheets undergoing wet repair, to prevent them from sticking together.
Wei T'O	:	A mass deacidification process using methyl magnesium carbonate to soak books previously vacuum dried.

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UNIT 2 EVOLUTION OF WRITING MATERIALS

Structure

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2.2 Evolution of Writing Materials

- 2.2.1 Stone and Metal
- 2.2.2 Clay Tablets
- 2.2.3 Papyrus.
- 2.2.4 Animal Skin

2.3 Early Writing Materials in India

- 2.3.1 General
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2.4 Paper

- 2.4.1 Introduction
- 2.4.2 How Paper is made
- 2.4.3 Varieties of Paper
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2.6 Answers to Self Check Exercises

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2.8 References arid Further Reading

2.0 OBJECTIVES

After reading this Unit, you will be able to:

- get a general idea of some of the more important materials which. had been widely used for writing purposes during the period of early human civilization;
- get an overview of the writing materials used in India, in particular, from the early period of history; and
- gather certain basic facts about paper, which is par se the most important writing and printing material all over the world today.

The *knowledge* gathered from this Unit will make your study of the 'concept of preservation and conservation' more meaningful.

2.1 INTRODUCTION

The history of writing and the history of human civilization are inseparable entities. Writing, and for that matter printing, notwithstanding our modem technologies, is still by far the

most potent and effective tool used in communication, and communication is the foundation of all human progress.

Scholars believe that our ancestors in the hoary past, millions of years ago, started written communications by using some signs and symbols, pictographic and ideographic characters (pictograms and ideograms) on *sand*. Sand does not hold written impressions on it for long, nor can the message impressed on it be transported from one place to another.

So began the human endeavour to search for suitable writing material on the one hand, and to devise suitable writing scripts on the other; each one, however, influencing the other to a great extent. This journey down the ages constitutes the history of writing materials from sand to paper, and writing scripts from prehistoric pictograms to our present day phonetic characters.

But it is not easy to construct this history in its totality. How soon man began to make *'books'* after the invention of writing is hard to ascertain conclusively because of the problem, of survival of the materials of whom these were created.

For example, from archaeological and direct or indirect literary evidences we learn that the Greeks and the Romans used waxed wooden tablets, the Chinese used wooden tablets, bamboo strips, silk and cotton fabrics as writing material very early in history, but very few of these specimens have survived.

In this Unit, we will restrict ourselves to only those materials which had widespread use for a fairly long period of time, and of which specimens still exit.

2.2 EVOLUTION OF WRITING MATERIALS

2.2.1 Stone and Metal

Writings on stone are the oldest examples of writing which have survived the vagaries of nature through centuries. Other more fragile materials, which might have been used for writing at various times, being destructible, have not survived, and our knowledge about them is mainly through literary references, and is not always quite conclusive. Writing on stone had to be done painstakingly with the help of chisels or some sharp tools. Once written, the message acquired a very long life. Inscriptions on stone slabs, on the sides of rocky mountains or on stone pillars, still exit in many parts of the world. The *Rosetta Stone* of Egypt which is more than 5000 years old, is one such typical and valuable example. Use of metal plates for writing purposes appears to have been introduced at a later date, but that too, quite early in history.

Inscriptions on stone mostly bear texts of special value, royal annals, religious codes of conduct and some such things, and the metal plates were generally used as documents of a more mundane nature like land grants, legal codes, interstate agreements and the like. These are available in a large number in, various museums of the World.

But the fact remains that neither stone slabs, nor metal plates could ever achieve the status of *"books"* for disseminating knowledge and information, as books do.

2.2.2 Clay Tablets

Something which is akin to the present day *'book'* was created by our ancestors the Sumerians, the Babylonians, the Assyrians and the Hittites. They used tablets made of water cleaned clay. While the clay was still soft, the writer used to inscribe writing on it

with the help of a stylus. After the writing was done, the clay tablet was either dried in the sun or for better, durability, burnt in kilns.

The tablets, which looked like bricks, were of different shapes and dimensions about five inches long. These burnt tablets were quite hard and almost indestructible.

Buried for thousands of years in the mounds of' long-forgotten cities, these have been recovered intact in the archaeological excavations in the 19th Century AD. The oldest tablets recovered so far were of Babylonian origin dating back to the fifth millennium B.C. From Babylonia, it appears that the use of clay tablets spread to Assyria and other areas to the West up to Egypt through commercial intercourse and conquests.

By writing on all the surfaces in small characters a writer could accommodate a, substantial amount of text on a single tablet. For longer texts several tablets were used linking them together by numbers and catch words as is done in modern books.

Archaeological excavations have so far unearthed lakhs of these tablets. The Babylonians and Assyrians kept huge collections of such clay tablets in their libraries. In 1833 a British Archaeologist Sir Henry Layard discovered a great public library of about 10,000 clay tablets at Nineveh, near what is now Mosul in Iraq. This Library is believed to have been created by Ashurbanipal, an Assyrian King in about 600 B.C. Other ancient cities as Ur, Nippur, Kish, Tellow are also credited with libraries of clay tablets. These collections of books on clay tablets contain history, mythology, mathematics, legal and commercial records.

The nature of surviving records indicates a heavy emphasis on the preservative function of writing and the book. The volume of such records indicates that reading and writing were taught in schools connected with temples and the practice of copying was very much prevalent.

Clay tablets bear a style of writing known as *cuneiform* writing. In fact, clay tablets and cuneiform writing went hand in hand. (Fig. 1). The wedge shaped stylus which was used for writing on soft clay invariably produced wedge-shaped marks, and these wedge shaped characters became the typical style of cuneiform writing. But when in the 6th Century B.C. the Aramaic language and alphabet arose, the use of clay declined because clay was not so adaptable to Aramaic characters as papyrus was; or may be that papyrus (on which writing was done by quill pen or brush) was not adaptable to cuneiform characters as clay (using wedge shaped stylus) was.

Fig. 2.1: Clay Tablet with Cuneiform Writing

2.2.3 Papyrus

If the clay-tablet was to some extent, akin to our modern book, the papyrus roll, is more nearly its direct ancestor. The Papyrus roll is of equal antiquity as clay tablet. About the

time the Babylonians were producing clay-tablets with cuneiform writing, the Egyptians learned to make beautiful writing material from papyrus plant. Papyrus, from which our paper derived its name, is a reed-like plant (Fig. 2). In ancient Egypt it grew abundantly in the shallows of the Nile delta. The stem of the plant is 3 feet to 10 feet in length, triangular and tapering in form.

The Egyptians used the stem of the plant for various purposes, such as, basket-making, weaving mats and sails of boats etc. But the most significant use for which papyrus has found its enviable place in history was its use as a writing material. Because of its various uses the growing of the plant was not entirely left to nature. The Egyptians in fact cultivated it in a big way to meet the growing demand for it, specially as writing material.

For preparation of writing material, the stem was cut into longitudinal strips, and the strips laid side by side, edges slightly overlapping. Across the layer another layer of shorter strips was laid at right angles. The two layers thus woven formed a sheet. After soaking in water and applying some glue or paste, the sheet was hammered and dried in the sun. Any roughness was leveled by polishing the surface with a smooth shell. To form a roll, several Sheets were joined together with a paste.

Fig. 2.2: Papyrus Plant

The sheets varied in size, ordinary ones measuring about 5"-6" wide, and generally not more than 20 sheets to a roll. The Egyptians usually used long papyrus rolls for books. A scroll in the British Museum, the Harris Papyrus, is 133' long. The Roman word for such a scroll was *volumen*, the origin of our word *volume*.

Papyrus rolls are represented in ancient Egyptian wall paintings, and many examples of the rolls themselves are available even today. It has been stated how cuneiform writing was created by wedge shaped stylus on soft clay. Similarly, papyrus affected the style of writing, creating what is known as *hieroglyphic* style. Scribes wrote on Papyrus with reed pens and ink of different colours. The, result was a very decorative style of hieroglyphic writing.

Compared to clay-tablets, papyrus is fragile; yet specimens of Egyptian papyrus dating back to 2500 BC, still exist. This amazing survival is partly due to the dry climate of Egypt., Another reason for the preservation of Egyptian papyrus rolls was the ancient

Egyptian funeral custom. They entombed papyrus rolls on which magic formulae were written, along with the dead body. Safely deposited in the graves, these, have survived. These mortuary texts are now, described collectively as the *"Book of the Dead"*.

Besides magical texts on papyrus, in the coffins of the dead, Egyptian papyrus rolls were used for other religious and ritual texts, hieratic, civil; and literary documents. For writing, the Egyptian scribe used both black and coloured inks. 'These inks were very much like, the inks we use today. The black ink was made from soot and vegetable gum. The coloured ink was made from special coloured powders.

The use, of papyrus as writing material spread from Egypt to Assyria, Greece, and Italy and gradually became the standard writing material in all the lands around the Mediterranean Sea. The widespread use of papyrus as writing material throughout the ancient world is attested by early writers and by documents and scriptures. Cited evidences indicate' that, papyrus was continuously used as early as 900 B.C. by the Greeks, who passed it on to, the Romans. The Greeks set up libraries of papyrus books in. all the cities they founded, from Sicily to the Black Sea. Alexander the Great is credited with the establishment of the famous library of papyrus books at Alexandria, a city built by him in 332 BC. Under his successors the library at Alexandria was the glory of the Hellenistic World. Scholars believe that this library contained more than 5,00,000 papyrus scrolls, representing the literature of all the known world, as far as India.

Today the largest collection of papyri (plural form of papyrus) is that of the Archduke Rainer in Vienna, well over 100,000 pieces, half of them bearing Arabic writing. Probably second in size is that of the Egyptian Museum in Cairo, followed by the Berlin Museum, the British Museum and the universities of Oxford and Michigan, following in that order.

The papyrus rolls, now in various museums, presented special problems of cleaning. These were mostly found dirty, crumpled stuck together with broken corners, and full of holes. The rolls had to be dehumidified, separated, sorted between sheets of blotting paper, glass or cellophane. Reading is done with magnifying glass and a mirror to concentrate light upon the text, and is often aided by infrared photography.

The reading and interpretation of the hieroglyphic writing on Egyptian papyri, their care and maintenance, constitute the Science or *papyrology.*

2.2.4 Animal Skin

Skin of certain animals has been used as writing material centuries ago. The animals whose skins were found appropriate were chiefly sheep, goats, and calves.

Parchment

Parchment is the generic term representing animal skins used for writing purposes. It is made by removing the hair or wool from the skin of the animal, and placing the skin in lime to get rid of its fat. The skin is then stretched on a frame and shaved with knives and scrapers.

Powdered chalk is 'rubbed on with pumice stone to smoothen and soften the skin.

These of parchment as writing material have this history: The successors of Alexandar the, Great developed the city of Pergamum near Constantinople in Asia Minor, as a centre of learning. When the library at Pergamum threatened to become more important than the one at Alexandria, the Pharaoh cut off the supply of papyrus to Pergamum. This was in about 190 B.C. when the supply of papyrus from Egypt dried up, that at the command of

Eumenes II, the ruler of Pergamum, experiments with animal skin started, to replace papyrus. The new material was known as *pergamemtum,* which is the origin of the word parchment.

From Asia Minor, the use of parchment quickly spread to the West, and in no time it started being used extensively by the Greeks and the Romans.

The comparatively large number of ancient and medieval, manuscripts that have survived enables us to gather some knowledge of the varieties of the material in different periods and in different countries.

The older method is to treat only one side (the flesh side). It was sufficient because the manuscript was in the roll form, where the writings were on the inside only. Later, dressing of both sides was adopted, making the skin suitable for writing on both sides: Parchment with two surfaces ensured the development of a form of book called *Codex,* where the sheets written on both sides were stitched together to form a book. This new form replaced the roll form, which was hitherto in use.

But there was always a difference in colour between the surface of the skin from which hair had been removed and the other surface, next to the flesh. The latter was white, more soft and tender than the former. This difference in the codex form of manuscripts is clearly visible in the older examples. To obviate this contrast, it was customary to lay hair side next to hair side, and ,flesh side next to flesh side, while making up the quires for a volume.

In the second century AD when parchment entered into competition with papyrus, it was not so skillfully prepared so as to be a dangerous rival. But the surviving specimens of the 3rd and the 4th centuries show a vast improvement with the introduction of a finer quality of parchment, particularly (i) *Vellum* and (ii) *Uterine.*

i) Vellum

It is made from the more delicate skins of calves, kids and lambs. As a rule, the vellum of early manuscripts, down to and including the 6th century, is of very good quality, of thin and delicate texture, firm and crisp, smooth and glossy. It was-very well prepared.

ii) Uterine (Vellum)

This thin, soft, tender, and extremely white variety of vellum was prepared from the skin of still-born or newly born calves, kids, and lambs. A remarkable instance of a codex composed of this extremely delicate substance is a manuscript in the British Museum, which is made up of as many as 579 leaves, without being a volume of abnormal bulk.

The art of dyeing vellum with rich purple colour was practiced both in Constantinople and in Rome at least as far back as the 3rd century. Manuscripts were written in silver and gold, adding great splendor to the codices (plural form of codex). A certain number of early examples of such magnificent manuscripts in uterine vellum still survive in a more or less perfect condition.

Self Check Exercise

1) What were the important early writing materials being used for centuries?

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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2.3 EARLY WRITING MATERIALS IN INDIA

2.3.1 General

As it had been almost everywhere, the earliest writing materials, which have survived in India too were stone and metal plates. Stone, whether as a rough block or as a smoothened pillar *(Silasthamba)* was used extensively for writing inscriptions. Metal glues, usually of copper *(tamra)* were used for engraving sacred scriptures, deeds of gift and so on. . A large number or archaeological evidences of stone inscriptions and copper plate engravings are in existence, spread all over the country. Literacy evidences also show that boards of wood *(phalaka - Samputa)* inscribed with chalk also served for writing records. In the 11th and 12th centuries AD, cotton fabrics impregnated with tamarisk resin *(pata)*, even fabrics of silk were also often used for writing. Unlike stone and metal-plates, the specimens of such writing materials, have disintegrated over the past centuries, and are practically non-existent except in literary references.

The typical Indian materials were birch-bark and palm-leaf. Compared to the other materials of which mention has been made in the above paragraph, birch-barks and palm-leaves are of lesser antiquity. Yet, because of their very extensive use for several centuries replaced only by paper, these have acquired special significance, requiring special attention.

2.3.2 Birch-bark

It is not exactly known when the use of birch-bark *(bhurja)* as writing material started in India (Fig 3). But it has been mentioned in *'0. Curtius'* as the prdominant writing material of India at the time of Alexander the Great. From its extensive use at the time it is obvious that it had been introduced much before the time of Alexander's invasion of India.

Birch-tree is of Himalayan origin. Its use, therefore, was generally restricted to the Northern India, especially in Kashmir and its adjoining areas.

Birch-bark sheets consist of a number of layers, collected from the inner side of the bark. These are thin delicate sheets, but quite strong and durable in texture. The sheets are peeled off and dried before writing on them, generally with black carbon ink or vegetable pigment. After writing, several sheets are collected in between two thin wooden boards for preservation.

The use of birch.-bark continued for a long time until eventually it yielded its place of pride to paper brought to India by the Arabs in the early part of the 13th century AD. In various museum collections in Northern India, particularly the state Museum in Kashmir, birch bark manuscripts in a large number are well preserved.

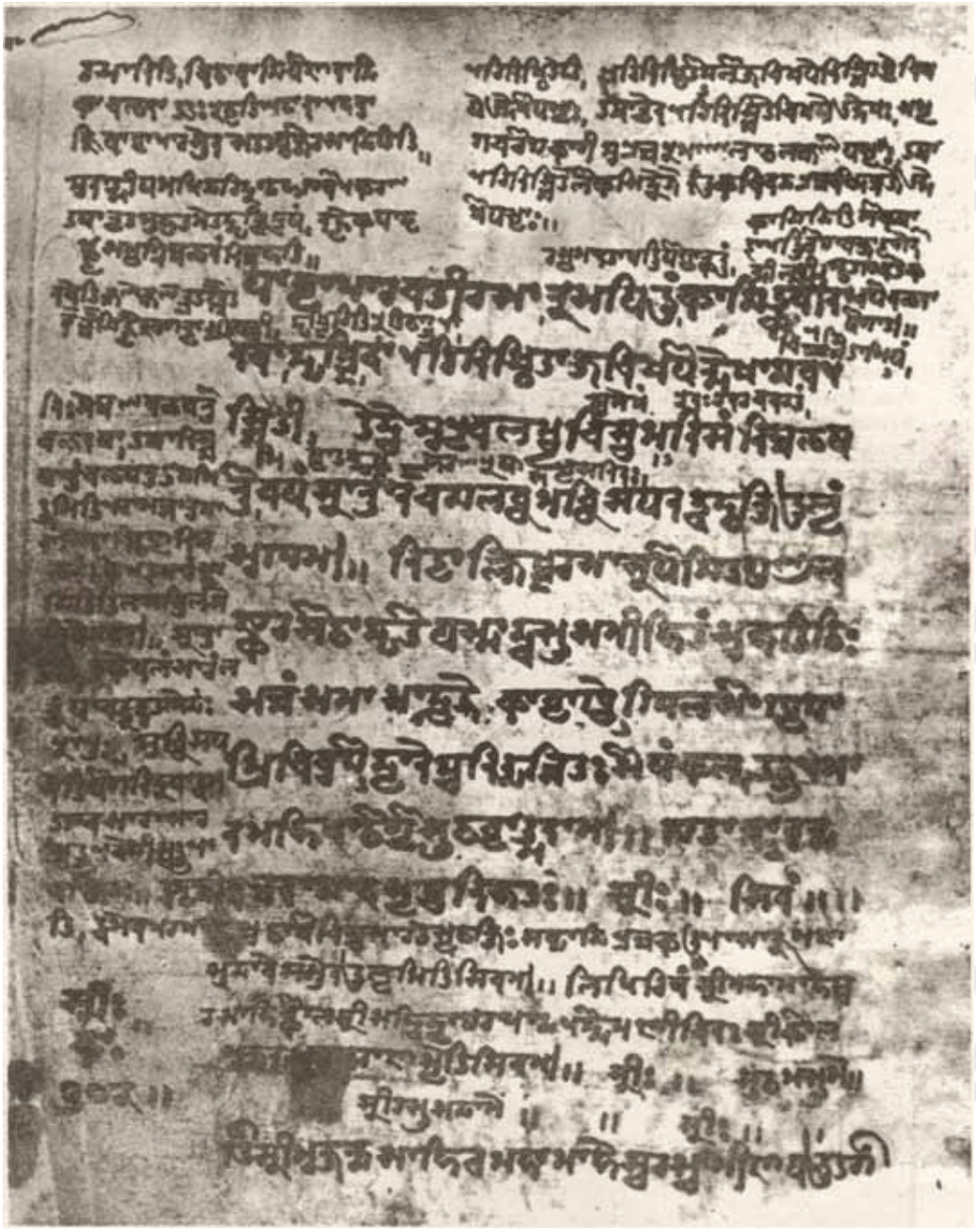

Fig. 2.3: Specimen of Birch-Bark Manuscript (Birch Bark Kavya Prakash)
By Courtesy: National Museum, New Delhi

2.3.3 Palm-leaf

Palm-trees grow abundantly in various parts of India, particularly in South India, Bihar, Orissa and Bengal. Its leaves have therefore, been more widely used as writing material than birch-bark (See Fig. 4)

Rajasekhara mentions two kinds of palm leaves; one is *tadipatra* for writing with pen and ink, which is the practice in northern India, the other is *ta/ada/a* for incising with metal stylus, the common mode in Southern India. .

In common parlance, the former variety is called sritala and the latter, tala. Sritala leaf is thin, flexible, and beautiful and can be handled like paper. It absorbs ink and can therefore be written on with pen and ink, manufactured from powered charcoal *(masi, meta)*. On the other hand, tala leaf is thick and coarse and is difficult to handle. It does not absorb written ink, and therefore, characters have to be inscribed with a stylus (sanskrit: *Sa/aka or lekani)* on the surface and then blackened with soot or charcoal, or alternatively (as for example in Madras) by rubbing them over with a dark, juicy leaf.

Palm-leaf manuscripts are pierced either in the middle (as for example in Orissa) or in two places., Through the holes, threads (Sutra) are drawn to hold a collection of individual leaves together, between two thin wooden boards.

A large number of palm leaf manuscripts are in the custody of various organisation and individuals throughout the country. Most of the palm-leaf collections date back to the 11th or 12th century AD. Manuscripts written as early as the 7th century AD are-reported to be available in Nepal. The oldest palm-leaf manuscript preserved is the Horiuzi MS, and is dated the 6th century AD. Interestingly, this material continued to be used even up to the early part of the present century in certain parts of India, because of the age old tradition of religious sanctity attached to it.

Self Check Exercise

2) What and how were the early writing materials in India used?

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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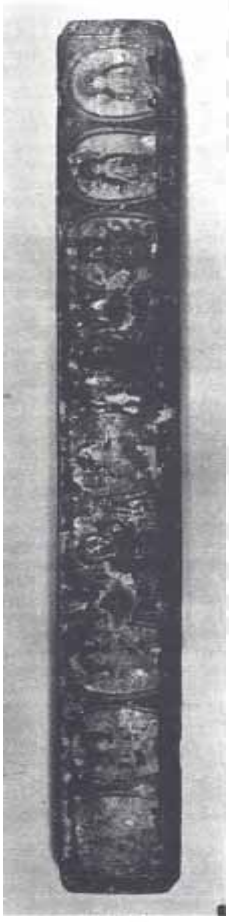

Illustration 4: Specimen of Palm Leaf Manuscript (Palm Leaf Panchraksha)

By Courtesy: National Museum, New Delhi

2.4 PAPER

2.4.1 Introduction

Paper is often. called "the handmaiden" of civilisation. Today, per capita consumption of paper is often considered as a reliable index to the cultural level of a nation and a measure of its natural wealth.

Paper is composed of cellulose fibres, a substance found in all plants. The plants which are specially used for paper making include trees like fir, poplar, pine etc., cotton plants, rice and wheat straws, grasses, hemp, jute etc. A large proportion of paper is produced these days from wood by extracting cellulose, though for manufacturing writing paper of a very high grade, cotton rags are still used.

2.4.2 How Paper is Made

For hundreds of years rags were the principal raw material for paper. However, these days most of the varieties of paper are made from wood pulp. Rag papers, which are very durable are used chiefly for documents, required for many years and for preservation.

Whatever be the raw materials used for making paper, its manufacturing process involves various stages like removal of undesirable constituents, reduction to fibrous state, bleaching, beating to pulp and converting the pulp into paper. Cellulose fibres which are the basic constituent of any type of paper need to be separated from non-cellulosic ingredients and the various steps involved in the process are:

I) Preparation of Pulp Wood

The Cellulose is separated from the materials, which hold it, through a. mechanical or chemical process. In the mechanical process bark free logs of wood are treated against a grind-stone by using an appropriate quantity of water to control the heat produced by friction. But use .of little effort in this process results in least desirable non-cellulose associates still remaining with the cellulose and giving us paper of poor strength and colour. Consequently, mechanical wood pulp is seldom used alone in manufacturing paper. It is, therefore, mixed with about 20% to 30% of chemical wood to set up paper. However, the paper that we get through this process is of a poor quality and its use is restricted to cheaper periodicals and newspapers.

In the chemical process, as its name indicates, solutions are used to dissolve non cellulosic materials in wood, bamboo, grass, rags, etc. under controlled high temperature and pressure. The concentration of chemicals used in the process is also regulated so that the cellulose is not adversely affected. Special care is taken while using wood as it is the hardest of all the said materials. Here, bark is removed first and then wood is cut into small pieces before they are subjected to a chemical treatment. The chemical process is further sub-divided into -three categories according to the variety of chemicals used for digestion:

i) *Soda Process*

In this process, raw materials like rags and grasses are treated with a solution of sodium hydroxide and sodium carbonate. But when straw is used as raw materials, calcium hydroxide is also added to the solution.

ii) *Sulphate Processes*

In this case, bamboo and wood is treated in a chemical solution consisting of a mixture of sodium hydroxide and sodium sulphate for getting pulp. The process is mostly used for manufacturing kraft paper required for wrapping purposes.

iii) *Bisulphite Process*

In this process, the digesting chemicals are magnesium bisulphite or calcium bisulphite or a mixture of these two chemicals is used in the presence of a free flow of sulphur dioxide gas. This process is generally used for treating wood chips.

II) The wood pulp is than washed to free it from chemicals used in any of the above chemical processes.

III) It is followed by passing the pulp through a series of screens to remove all impurities.

IV) Water is then drained off to form a thick mass.

V) The pulp is then bleached in a solution of chlorine and hypochlorite, and washed again thoroughly to remove traces of chlorine.

VI) The pulp is then beaten in a Beater (large oval shaped vat) to rub and press the cellulose.

VII) It is then passed through *Jordan Machine* to brush the fibres and cut them to proper length.

VIII) It is then passed through *Fourdrinier Machine.* The bed of this machine is very long; the first part, called the wet end; is made up of a wire-cloth belt on which the fibres are allowed to mat, or felt, into the form of a sheet. The sheet is then dried in the second part, i.e., the 'dry land' by being passed over a number of suction boxes which drain out most of the water.

IX) The sheet is then squeezed between heavy press rolls and then passed over a number of steam-heated drier cylinders.

Finally, the paper passes through *Calender presses* where a smooth surface is put on the sheet by. using sizing materials, "Such as clay, resin, starch, alum etc., which provide different types of surface finish to the paper.

XI) The paper is then wound into a large roll or cut into sheets and packed in reams (480 sheets or 500 sheets.

2.4.3 Varieties of Paper

By blending different kinds of pulp, by using different kinds of sizing material, and by applying different types of manufacturing techniques, a large variety of paper suitable for different kinds of use, can be produced. Some of the broad varieties are listed below:

i) *Newsprint* is made by using a blend of one part sulphite pulp and three parts of mechanical or groundwood pulp.

ii) *Durable writing paper:* uses rags or sulphite pulp or a mixture of the two.

iii) *Bond paper* is a superior quality paper, generally used for business letter-heads. A heavy quality of bond paper is called -*ledger paper* which is used for keeping records.

Bond papers contain *water-mark,* produced by wire-mesh design which is pressed against the wet pulp sheet before It is fully formed on the Fourdrinier Machine.

iv) *Laid paper and Wove paper:* A paper having a gridiron appreciate is called laid paper; and the one with plain surface is called wove surface. Among the papers in this group are drawing papers, onionskin paper, bank-cheque paper etc.

v) *Art paper:* Smooth glossy paper, also known as coated paper. The base paper is coated on both sides with china clay and casein glue and then glazed under pressure between rollers.

vi) Imitation Art paper: Unlike Art paper, which is coated Imitation Art Paper is 'loaded' by adding clay and glue to the pulp itself.

vii) *Parchment Paper:* This has nothing to do with animal skin. Also known as 'vegetable parchment' this variety of paper is made by dipping unsized (i.e., without using sizing material) into a cooled mixture of Sulphuric acid and water, and then washing and drying it under pressure. This process makes the paper partly transparent and much stronger than ordinary paper. It is used for legal documents, and maps etc.

2.4.4 History of Paper

As has been stated above, paper gets it's name from Egyptian papyrus. Paper, as we know, was invented in China in about AD 105. The Chinese art of paper-making spread to other parts of the world, after several Chinese paper makers were captured in battles fought between the Arabs and the Chinese in Russian Turkestan. The Moors at Samarkand learnt the technique from them. Paper industry was established in Baghdad in AD 795. Subsequently, as a result of the Crusades and Moorish conquest of Northern Africa and Spain, the knowledge of paper making spread to Europe.

Paper was introduced in India by the Mohammedans the oldest Indian paper manuscript is said to date from 1223-24 AD. It first replaced birch-bark and later palm-leaf (See Fig. 5 for specimen of old paper manuscripts).

For several hundred years art paper was made by hand from the rag pulp. The paper was very strong, but the process was very slow. In 1750 a machine was invented in Holland which reduced the time necessary to break down the rags to fibres. In 1798 a machine to make paper in a continuous roll was invented in France. It was improved by Fourdrinier brothers in 1803.

In 1840 a German invented a process of grinding logs into a fibrous pulp and in 1867 an American invented the chemical process of separating the fibre from the wood by dissolving it in a solution of sulphurous acid. This process was rapidly improved upon in Europe, so that by 1882 wood pulp was made by processes similar to those in modern paper mills.

Fig 5: Specimen of Old Paper Manuscript (Illustrated Paper Ms Mandu Kalpa Sutra) By Courtesy: National Museum. New Delhi

2.4.5 Units of Measurement

Size of paper are expressed in inches or centimeter according to the country of manufacture. Some of the sizes in common use were given names, such as, atlas, crown, demy, foolscap, royal etc. but such names have been largely discontinued in favour of actual measurements.

The common sizes of paper, which are now marketed in India, are:

46 cm	x	56 cm -	commonly expressed as	18" x 22"	size	
43 cm	x	68cm -	”	17” x 27"	”	
51 cm	x	76cm -	”	20” x 30"	”	
58.5 cm	x	91 cm -	”	23” x 36"	”	and so on.

The traditional count is in quires of 24 sheets, and reams of 20 quires (i.e., 480 sheets), but custom here also has changed, and most calculations are based on units of 500 sheets in a ream. The weight of paper is expressed in GSM (grammes per-square metre of a sheet). Out of the three parameters viz. Size, GSM and total weight of a ream, if any two are known, the third can be easily calculated.

In common parlance when we come across a term like: “Twenty-thirty paper, 13.5 kg”, we can easily understand that the size of paper is 20" x 30" (approximately) i.e., 51 cm x 76 cm, and the weight of a ream is 13.5 kg.

In assessing the quality of-any paper, the GSM, the texture and the surface finish are all to be considered together.

Self Check Exercise

3) How is paper composed and what are its varieties?

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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2.5 SUMMARY

This Unit discusses the materials used for writing purpose right from the early human civilization till date in India. The various stages of development of writing materials i.e., from stone and metal to paper being used now-a-days.

In the early days stone and metal, clay tablets, Papyrus and animal skins were used as writing materials. The animal whose skins were found appropriate were used for the purpose namely sheep, goats and calves. Subsequently the typical Indian materials known as birch-bark and palm-leaf were extensively used. Finally paper became the essential writing material of the present day civilization.

Composition of paper and the various steps involved in the process, varieties of paper, history of the paper, sizes of the paper (units of measurement) etc. have been discussed in detail in this Unit.

After going through this Unit a student will be able to form an idea on the growth and development of writing materials from early days to the present day. However, only widespread materials used for a long period are brought to the knowledge of the students through this Unit.

2.6 ANSWERS TO SELF CHECK EXERCISES

1) Some of the important early writing materials commonly used were Stone and Metal, Clay Tablets, Papyrus, Animal Skins etc.

2) The early writing materials used, in India were Birch-bark and Palm-leaf. Birch-bark consists of a number of layers collected from the inner side of the bark. These are thin delicate sheets which are peeled off and dried before writing on them, generally with black carbon ink or vegetable pigment. Palm-leaf is of two kinds such as *tadipatra* and *ta/ada/a.* The former variety is meant for writing with pen and ink and the latter is for inscribing with a metal stylus on the surface and is then blackened with soot or charcoal.

3) Paper is composed of cellulose fibre, a substances found in all plants. The plants which are specially used for paper making Include trees like fir, poplar, pine etc., cotton plants, rice and wheat straws, grasses, hemp jute etc. A large proportion of paper is produced these days from wood. Some of the broad varieties of paper are:

   i) Newsprint
   ii) Durable writing paper
   iii) Bond paper
   iv) Laid paper and Wove paper
   v) Art paper
   vi) Imitation Art paper
   vii) Parchment paper.

2.7 KEY WORDS

Book of the Dead : The ancient Egyptians were obsessed by a concern with life after death. They wrote magical formulae on papyrus rolls and entombed these along with the Coffins. These mortuary texts are collectively described as the 'Book of the Dead'. These provide the specimens of the earliest Egyptian writings on papyrus rolls.

Codex : The name given to the earliest forms of manuscripts in book form, i.e., the collection of written pages stitched together. This form replaced the earlier roll form of papyrus or leather manuscripts.

Cuneiform : This term is derived from a Latin word, meaning 'wedge-shaped'. It is one of the most widespread and historically significant writing system in the ancient Near East. The origin of the cuneiform may be traced back approximately to the end of the 4th millennium BC, and is attributed to the Sumerians. Due to the prevalent use of clay tablets as writing material the linear strokes acquired a wedge

Manuscript		shaped appearance by being pressed into the soft clay, with the slanted edge of a stylus.
Hieroglyphics	:	Egyptians developed a word-syllabic writing, known as hieroglyphic, about 3000 BC. It is a kind of picture writing. The Greek word hieroglyphic means sacred carving. The Greeks believed that only Egyptian priests understood and used this system of writing. This belief persisted until the 1800's, when scholars deciphered the writing.
Ideogram	:	A form of primitive writing expressing a way of expressing Ideas, not necessarily in words, is called ideography. Pictures drawn for the purpose of communication differ only slightly from pictures drawn for artistic purposes. Communication pictures are, however, simplified and stereotyped, with no details that are not needed as part of the communication.
Illuminated	:	The term "illuminated" is used to describe the brilliant book ornamentation, which was developed in the Middle Ages. Later, it has been extended, by usage, to the illustration and decoration of early manuscripts in general.
Phonetic Writing	:	It is a word-syllabic system of writing. The Sumerians devised a fully developed form of it around 3000 BC. This system, was later developed as alphabetic system, first by the Greeks in the second millennium BC in which a symbol represents a single sound of a language.
Rosetta Stone	:	It is a piece of ancient Egyptian Stone, bearing inscriptions. It is now preserved in the British Museum. It was found near that town of Rosetta or Rashid on the bank of the river Nile. It was discovered in 1799 AD. The inscription records the commemoration of the accession of Ptolemy V to the throne of Egypt in 196- I 97 BC. The inscription is in two languages and three scripts (Hieroglyphics, Demotic and Greek).

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UNIT 3 PALM LEAVES AND BIRCH BARK: THEIR NATURE AND PRESERVATION

Structure

3.0 Objectives

3.1 Introduction

3.2 Palm Leaf Manuscripts: Salient Features

- 3.2.1 Antiquity
- 3.2.2 Salient Characteristics
- 3.2.3 Preparation of Leaves for Writing
- 3.2.4 Writing
- 3.2.5 Format

3.3 Preservation Methods

- 3.3.1 Method of Storing
- 3.3.2 Storing Environment
- 3.3.3 Protection from Insects
- 3.3.4 Fumigation
- 3.3.5 Repair and Restoration

3.4 Birch Bark Manuscripts: Salient Characteristics

- 3.4.1 Antiquity
- 3.4.2 Salient Features
- 3.4.3 Causes and Nature of Deterioration
- 3.4.4 Repair and Maintenance

3.5 Summary

3.6 Answers to Self Check Exercises

3.7 Key Words

3.8 References and Further Reading.

3.0 OBJECTIVES

After reading this Unit you will able to:

- know the extent of their use as writing materials during the past centuries;
- understand their typical characteristics;
- explain the method of processing to suit their use as writing materials; and
- discuss their care, repair and preservation aspects.

3.1 INTRODUCTION

In India palm leaves and birch bark are two typical writing materials of great antiquity. Palm leaves and birch bark were introduced in India as two typical writing materials,

centuries before the advent of paper. Some introductory references about these materials have been given in the earlier Unit. A more elaborate treatment on these two is given in the following paragraphs of this Unit.

There are a considerable number of collections of lndological and Oriental Literature in libraries, museums, and archives, spread all over the country. A significant part of these collections consists of palm-leaf and birch bark manuscripts. Such manuscript collections are also held in temples and monasteries and even by individuals as their personal collection.

Except in a few established libraries, museums and archives, these manuscripts are mostly lying scattered, and uncared for. In some cases these are stored in an unscientific manner which has already caused, or will eventually cause, serious damage to them in the long run. Unless suitable remedial measures are taken and the already damaged manuscripts are properly repaired and stored in a scientific manner, the damage caused to them will eventually be beyond salvage. And this will be a great loss to one of our most precious cultural heritage.

3.2 PALM LEAF MANUSCRIPTS: SALIENT FEATURES

3.2.1 Antiquity

As has been stated above palm leaf as writing material is of great antiquity. We know of palm leaf manuscripts located in the deserts of Takia Makan in Central Asia. But there is no mention in the literature to determine correctly how old these really are. The earliest available examples of writings on palm leaf seem to belong to the 4th century A.D., only the most important being some fragments from Kashghar in the Godfrey Collection. Manuscripts using the script of Gupta period of lndian history (Cir. 6th Century A.D.) are preserved in the monastery at Horiuzi in Japan. Palm leaf manuscripts written in later Gupta script (7th Century A.D) have I been reported to be available in Nepal.

In India the available specimens of palm leaf manuscripts dating the 10th Century A.D. and earlier are very few. The reason obviously is that most of these specimens have disintegrated for lack of care and attention. However, more specimens dating from the 11th Century A.D, and onwards have come down to us in large number. These are available in various libraries, manuscript repositories and private collections in the country. This indicates the large scale use of palm leaf as writing material during the l1th and 12th Centuries A.D. and thereafter.

There are several *Jnanabhandara* (libraries) relating to Jainism in the fort at Jaisalmer, having a large collection of palm leaf manuscripts. The oldest collection is in the fort near Shambhunat Jain temple. In this collection there is a manuscript '*Panchami Kaha'* which was written in 1109. Vikrama Samvat, corresponding to 1052 A.D. The Pattan *Manuscript bhandars* (repositories) in Gujarat contain certain very ancient manuscripts. The earliest dated manuscript is that of *Nisitha Churni,* which bears the date of Vikrama Samvat 1157, corresponding to A.D. 1101. There are a few more manuscripts in this collection, which by appearance and, from paleographical evidence appear to be older; but their dates have not yet been conclusively established.

The instances quoted above are to indicate the antiquity. These are illustrative and far from being exhaustive. The use of palm leaf as writing material was so extensive in India in the past that palm leaf manuscript collections are available almost everywhere in the country, especially in the southern peninsula and in eastern India where palm trees grow in abundance. One of the reasons for its widespread use is the religious sentiments attached to palm leaf

as writing material. And this is the reason why we find that its use in writing religious scriptures continues long after paper was introduced in India.

3.2.2 Salient Characteristics

A typical palm tree has a slender trunk with no branches. It has a cluster of leaves at the top. There are many varieties of palm, which grow in abundance in almost all the continents and in the tropical islands of the Pacific.

In India there are two distinct varieties whose leaves are such that these can be processed with ease and used conveniently as writing materials.

These are:

i) *Sritala* (*Corypha umbracaulifera*) In south India this variety, known as *Karimana,* is mostly grown, especially in the Malabar Coast. Leaves of Sritala, also known as talipat palm, are thin, crisp, flexible and beautiful. It was the only type of palm leaves which were used through out India in the earlier period.

ii) *Tala (Borassus flabillifer)* In the South, this variety is known as *thalivola.* Leaves of tala, also known as palmyra palm are thick and coarse. It is indigenous to South India, and it grows abundantly, not only in the Malabar Coast, but also in other parts of the country, especially in Orissa and Bengal, and also in Sri Lanka. (From this variety generally toddy is extracted). .

The leaves of Sritala are thin and flexible, but those of tala are thick and coarse.

3.2.3 Preparation of Leaves for Writing

When the leaves of a grown up tree sprouts from their sheath and are just beginning to spread out, these are cut. Before cutting out the strips to manuscript size, bunches of the leaves are seasoned. The traditional method of processing is as follows: Different processing methods were adopted at different places to season the leaf. At some places fresh and soft sritala leaves cut from the tree were dried in the sun for several days and then buried in mud for three months. Turmeric powder paste was also applied on them. Sometimes they were exposed to smoke in the kitchen for a number of days. At some places the leaves were dried and boiled in water. Any abnormal growth was then pared off with a knife. All these practices were supposed to be an effective measure against insect attack.

The leaves so processed were dressed and cut to the required size.

3.2.4 Writing

The leaves of Sritala are thin, flexible and have the capacity to absorb writing ink. Before writing, however gingili oil seems to have been applied on the surface to smoothen and adopt the surface for writing on it.

Writing was usually done by reed pen and ink prepared from powdered charcoal (or some such carbonaceous ink).

On the other hand, tala leaves being thick and coarse and also that they do not absorb ink, characters had to be inscribed with a steel stylus on the surface. The writings were then brightened up by rubbing lamp black or true indigo on the surface; and excess ink on the surface was wiped off with the help of cotton swab. Rubbing with juicy leaves instead of lamp black or indigo, was also practiced as an alternative.

Even in modem days, literature printed (not hand written) on palm leaves have come to notice, and this is done not because of any special convenience, but for the sake of creating novelty.

3.2.5 Format

Palm leaves are narrowed in width, generally 3.5 to 4.0 cms. But these are pretty long in size, to suit the requirement of writing on them; they were cut into strips of suitable length. The dimensions of manuscript strips, generally available, vary from 10.0 cms. to 90.0 cms x 3.5 cms. or 4.0 cms. The longest manuscript size available in the Pattan Bhandars in Gujarat is 95 cms. x 6.5 cms. approximately.

Writings on the strips were done in lines parallel to the length of the strip; but if the strips used were longer, this was done in columns.

After writing, these strips were traditionally placed between two wooden planks of a size slightly larger than the strips. The strips were pierced in the middle, or if the length is more, at two places and holes were pierced also in the wooden planks at corresponding locations. Cords were passed through the holes of the manuscript strips, the loose ends of the cords passed through the corresponding holes in the wooden plank covers and then the whole tied round. This way the manuscripts were securely kept in position.

Self Check Exercise

1) Discuss the salient characteristics of Palm Leafs.

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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3.3 PRESERVATION METHODS

3.3.1 Method of Storing

Manuscripts placed and tied between wooden, boards (as stated above) were generally wrapped in cloth to keep off dust and worms. It is interesting to note that the colour of the cloth used for wrapping was traditionally red or yellow, and sometimes white, but never of any other colour. It was generally believed, and truly so, that red is a repelling colour for worms, and yellow, if prepared by turmeric solution, has germicidal property. Silk protects against book-worms remarkably well, but its use was restricted, obviously because of its higher cost.

In large manuscript repositories these bundles of manuscripts are kept in wooden or steel boxes of varying sizes according to the size of the manuscripts, or in almirahs or even in cardboard boxes.

This time-tested traditional method of storing has remained basically unchanged over the past centuries. All important repositories of palm-leaf manuscripts, as well as in Libraries where considerable bulk of such manuscripts is in existence, this traditional method of storing, with marginal modifications, is still in vogue.

This traditional method of storing, however, poses certain problems:

i) The practice of tying with cords often damages the edges of the leaves. If the tying is too light it puts uneven pressure on the manuscripts, causing them to crack at places. On the other hand, if the tying is too loose, it causes avoidable strain on the leaves owing to friction.

ii) Equally risky is the method of passing cords through the holes in the manuscript leaves. The leaves often tend to crack in all direction starting from the holes; and more so when the manuscript is in frequent use.

iii) Wrapping the manuscripts in cloth, no doubt, facilitates air circulation and protects them from dirt, dust and dampness; but the acidic contents of the cloth, often present, causes damage to the edges of the manuscripts.

Experience has shown that the best method of preservation is to store the manuscript leaves loose in card board boxes. The resultant loss in flexibility is more than compensated by the survival of the leaves in an entirely unimpaired state. The boxes used for the purpose should be slightly bigger than the size of the manuscript-leaves, spacious enough to accommodate the leaves without bringing their edges into friction with the inner walls of the boxes.

The best method, however, to eliminate all risks, is to inlay each of the leaves, i.e., to encase it in a frame made of pulp board or hand made paper, in the form of an envelope of requisite size and thickness.

3.3.2 Storing Environment

High temperature and low humidity are extremely injurious to palm-leaf manuscripts; worse still, if there is wide ranging variation of these factors. These two factors over a period of time turn manuscripts brittle. Extreme variations in temperature and humidity cause disintegration; the manuscripts often get lumped together into solid blocks, defying all attempts at restoration. Persistent neglect in this respect has been responsible in the past for the decay of many collections and even the total disappearance of not a few.

The ideal environment for long term preservation is to have a constant temperature between 22-25° C (72-77° F) and Relative Humidity between 45-55%. This is possible only by air-conditioning. If that is beyond means - circulation of clean fresh air by using exhaust fans in the storing area should be ensured.

3.3.3 Protection from Insects

Apart from regular vigilance and maintenance of cleanliness in the storing area, adoption of certain basic pest-control measures are essential.

Use of Insect Repellants- The most formidable enemy of palm-leaf manuscripts in tropical conditions is the so called 'book worm' *(gastrallus indicus).* These pests make perforations all over the leaves, whenever an opportunity comes. Their ravages are in abundance among collections, which are not protected by the use of disinfectants.

To protect palm-leaf manuscripts adequately against possible ravages of insect pests, particularly the 'bookworms', leaves of aromatic plants or medicinal herbs have been,used traditionally. Fine powders of such leaves or herbs are packed into small cloth bags, and 2-3 such bags are placed in the boxes containing the manuscripts. *Pindr,i* a kind of aromatic grass and *ghorbachch,* a medicinal herb *(acorus calamus)* used in this manner in the past as insect repellants, were found very effective. The efficiency of such grasses and herbs is due to the active ingredients which are volatile, and as such, their insect repellent properties are lost after some time. At that stage these are require to be replaced. Neem leaves also have been found to be quite effective for their insect repellant property.

In modem practice naphthalene balls or camphor packets etc. which are very effective insect repellant are used in many manuscript repositories. Naphthalene balls or camphor packets are placed in the manuscript boxes. These, however, have to be replenished at regular intervals.

3.3.4 Fumigation

When it is noticed that some manuscript leaves are already infected by insect pests, fumigation becomes necessary to eliminate active infestation. One of the very simple methods of fumigation, which has been found very effective by the National Archives of India, and which can be managed in-house by any manuscript repository, is to use paradichlorobenzene in an air-tight steel vault. To get the best effect, the relative humidity in the vault should be approximately 65%. This can be achieved by keeping saturated solution of sodium chromate or magnesium acetate in the fumigation vault.

Use of a mixture of carbon tetrachloride and ethylene dichloride (1:1) has also been found to be a satisfactory fumigant for palm leaf manuscripts.

In certain cases the carbonaceous ink used in the manuscript may show a slight tendency to smudge or smear in the process of fumigation. Writings in such inks should therefore, have to be protected by hand lamination process.

3.3.5 Repair and Restoration

i) Accumulated dust on palm leaf manuscript gradually erases the writing. Superficial dust on them is cleaned by a soft brush. In case ink on them is water soluble acetone, benzene or carbon tetrachloride can be successfully used for cleaning them, However, if the ink is not washable in water, a mixture of glycerin: water and glycerin: alcohol can be used.

ii) Palm leaf manuscripts written with carbon ink (on *Sritala),* if faded, cannot be restored, but in the case of those inscribed with stylus (on *tala),* restoration is possible. The process of re-inking is to rub graphite powder on the surface with cotton pad and cleaning the excess carbon from the surface with a cotton swab.

iii) Old and brittle leaf has to be reinforced for its safe preservation. Chiffon repair provides satisfactory reinforcement. For extra protection, the chiffon reinforced leaf should be inlaid in an envelope made of handmade paper or pulp board of appropriate size and thickness.

iv) When several palm leaf manuscript sheets get stuck together to form a solid block, they need to be separated very carefully. The various methods available to us for separating them are:

a) Expose them to moisture or place them in a humidification room. Each leaf is separated when they are sufficiently moist by a blunt spatula or knife.

b) Placing them in a bath of hot water (60°c) containing 5-10 cc of glycerin. Each leaf is separated carefully.

c) Immerse them in a bath of hot liquefied Paraffin (70-80°C). Each leaf is separatedand washed with acetone. This method can be used for palm leaves having water soluble writings.

Self Check Exercise

2) What are the different methods of preserving palm leaf manuscripts?

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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3.4 BIRCH BARK MANUSCRIPTS: SALIENT CHARACTERISTICS

3.4.1 Antiquity

Centuries ago, in many countries of Europe and North America, birch bark had been occasionally employed in writing short notes and letters. Bibliotheque Nationale in Paris has in its collection two letters on birch bark, one dated 28 June 1647 and the other dated October 1676.

The earliest known manuscript on birch bark has been found at Khotan in Central Asia, and from extant records and literary descriptions it is now certain that this material was widely used in Central Asia and in the northern region of India in much earlier period of History. The historian of Alexander the Great, Quintus Curti us Rufus, while enumerating the various curiousities of India made the following statement:

"Tender bark of trees takes the signs of letters just like sheets of papyrus".

This statement of Curtius dates back to the 1st Century A.D. but the information which it provides dates back to the time of Alexander's invasion, that is, the 4th Century B.C. and since the material was widely used at the time of Alexander's invasion it can be well assumed that the practice had been of much older origin.

In India, the more recent manuscripts on birch bark in larger number come generally from Kashmir and other Himalayan regions, where birch trees grow in abundance. It is obvious that the use of birch bark, which in Indian language is known as *'Bhurjapatra'* continued for a long time, even after paper was introduced in India by the Arabs in the early part of the 13th Century A.D. It is also obvious that it was introduced very early in history, although very few specimens of the earlier period are available, because of the deteriorating effect of damp climatic condition of the Himalayan region.

3.4.2 Salient Features

Birch bark sheets are collected from the inner side of the bark tree. The sheets are composed of a number of very thin layers. The sheets are peeled off and dried before writing on them. The sheets are delicate, but quite strong in texture. Writing is done generally with black carbon or vegetable pigment.

Originally the birch bark manuscripts were in the form of rolls, composed of sheets held together at the two sides by thread stitched within one centimeter of the edge. In appearance the rolls were like papyrus rolls, and the 'book' so created was like a 'volumen' of classical antiquity. One such manuscript of the *'Bhagavatgita'* preserved in the Bibliotheque Nationale in Paris is precisely a roll of birch bark, 1760 mm in length and 45 mm. in width.

3.4.3 Causes and Nature of Deterioration

Most of the ancient manuscripts which have come from Central Asia are in fairly good condition. The dry climatic condition of that region as well as the method of storage in stupas has contributed greatly to their present state of preservation. On the other hand, most of the manuscripts which have come from Kashmir and other Himalayan regions, having been subjected to natural dampness for a longtime, have suffered a great deal. The bark does not get softened by water, but under damp condition for a long time. The sheets get stuck together. When an attempt to open the manuscript is made, the sheets often crumble to dust. Thus, d*ampness is one of the worst enemies of birch bark manuscripts.*

Also, the bark is made up of very thin skin-like layers which at times fall apart along the natural line of cleavage. The damage generally begins at the free edge of the sheet against which the finger is rubbed when turning over the sheets; and it easily spreads through the whole piece of bark sheet.

Birch bark is insect resistant. In an experiment conducted in the National Archives of India it has been found that birch bark contains 15-20% of solid material, which is a mixture of methyl salicylate, tannin and wax. The resistivity of this material is attributed to the presence of methyl salicylate in it.

3.4.4 Repair and Maintenance

In 1948 Kashmir Government passed on to the National Archives of India the Gilgit Collection consisting of 1800 manuscript sheets of birch bark (Himalayan birch - *Betula Bhojpattra).* The sheets varied in size from 27" x 2 5" to 9"x 2", and were in a very poor, brittle condition. The repair work carried out in the National Archives of India, has been very satisfactory and can be considered as an acceptable process of repair of birch bark manuscripts. The process was as follows:

The sheets were repaired with Chiffon gauge and flour paste. When the repaired sheets were partially dried, these were kept under pressure between glass pieces. When fully dry, the result was very satisfactory. It was found that the flakes on the top layers, which had come out from the bark got very nicely stuck to the next layer, the paste entering the layers through the torn and broken places. After repair the sheets were guarded with handmade paper, gathered, sewn and bound into volumes.

Manuscripts whose pages have got stuck, can be first separated by exposure to water vapour before undertaking any required repair process.

The ideal storage condition for birch bark manuscript collection is similar to the one required for palm leaf manuscripts, even though the former is less affected by variation of temperature,

and humidity and also insect menace as compared to palm-leaf manuscripts.

Self Check Exercise

3) How does deterioration of birch bark manuscripts take place and what care should be taken for proper maintenance of these birch bark?

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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3.5 SUMMARY

The present Unit entitled "Palm leaves and Birch Bark: Their Nature and Preservation" discusses some of the important salient features of both palm leaf manuscripts as well as birch bark manuscripts. These two traditional forms of writing materials contain lot of original information of our rich cultural heritage. Right from the beginning of collecting palm leaves and preparing the same for writing format need utmost care. Once writings are completed, it needs a lot of care to preserve it. Some of the methods of preservation have also been discussed such as proper storing, good environment, protection from insects, fumigation, restoration etc., The same steps are also taken for preserving the birch bark manuscripts.

3.6 ANSWERS TO SELF CHECK EXERCISES

1) A typical palm tree has a straight, slender trunk with no branches. It has a cluster of leaves at the top. There are many varieties of palm, which grow in abundance in almost all the countries and in the tropical islands of the pacific. In Indian there are two distinct varieties' whose leaves are such that these can be processed with ease and used conveniently as writing materials. They are: Sritala and Tala. The leaves of Sritala are thin and flexible, but those of Tala are thick and coarse.

2) The different methods adopted for preserving the palm leaf manuscripts are storing it in woodden or steel boxes, good environment, protection from insects, fumigation and constant dusting, cleaning, repair and maintenance.

3) The deterioration of birch bark manuscripts occurs due to unsuitable climatic condition and basic method of storage. Dampness is one of the worst enemies of birch bark manuscripts. As far as possible those manuscripts should not be exposed to humidity and insects and dampness.

3.7 KEY WORDS

Hand Lamination : The process provides a coating of Chiffon and fixing cellulose acetate foil to it by means of acetone.

Kashghar : Town and Caravan Centre in the West Sinkiang Province of China, near the edge of Takla Makan Desert.

Palaeography : Ancient modes of writing, study of ancient modes of hand writing.

Takla Makan : Desert occupying the Central part of Sinkiang Province of Western China.

3.8 REFERENCES AND FURTHER READING

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UNIT 4 MANUSCRIPTS, BOOKS, PERIODICALS, NEWSPAPERS, PAMPHLETS ETC.

Structure

4.0 Objectives

4.1 Introduction

4.2 Deterioration of Materials

4.2.1 Inherent Causes

4.2.2 External Causes

4.2.3 Human Causes of Deterioration

4.3 Strategies for Preservation

4.4 Summary

4.5 Answers to Self Check Exercises

4.6 Key Words

4.7 References and Further Reading

4.0 OBJECTIVES

After reading this Unit, you will be able to:

- identify the problems relating to the print on-paper category of reading materials, from the preservation point of view;
- discuss the inherent weakness of the materials;
- describe the external causes of their deterioration;
- explain the need for a suitable, comprehensive preservation programme; and
- elaborate the content and strategy of such a programme.

4.1 INTRODUCTI 0N

Libraries today have in their collections an ever growing variety of materials in non-book formats: films, film-strips, microfilms, microfiches, optical discs, sound recordings, magnetic media, and so on. These are considered as technological alternatives to print-on-paper. Yet, we cannot visualise a stage where these alternatives will totally replace paper, in any foreseeable future. In fact, inspite of all these technological innovations, the rate of growth of paper-based reading materials in our library collections, all over the world, has been accelerating at a tremendous pace; and one of the basic parameters for assessing the level of progress of a country is still accepted to be the level of its consumption of paper.

Moreover, there are already huge collections of paper-based materials accumulated over the past many centuries in our libraries, and a very considerable part of these is too precious to neglect.

Estimates may vary from library to library, from country to country, but the fact, based on various surveys indicates that at present at least 25% of the world's great collections are

progressively turning to dust because of the inherent fragility of paper and the lack of serious concern for its paper preservation. Unless serious attention to this problem is paid without further loss of time, these collections will progressively deteriorate beyond salvage and will eventually turn to dust.

After many decades of neglect the curatorial role of the librarians is now gradually being recognised as one of their major professional responsibilities. Preservation is now forming an essential part of the growing art of collection management, and the collection to be managed is composed primarily of reading materials on paper.

In this Unit, we will deal with the preservation of reading materials on paper, available in our libraries in various formats, such as, manuscripts, books, periodicals, newspapers, pamphlets and so on.

4.2 DETERIORATION OF MATERIALS

Before considering preservation methods and strategies for paper-based products, we should identify the causes of their deterioration. The causes fall under two broad categories:

a) Inherent Causes

b) External Causes

4.2.1 Inherent Causes

Paper Structure: Inherent strength of paper depends basically on the strength and length of organic fibres constituting it. The aggregate of fibres are bound by a dilute adhesive material usually composed of glue or gelatin, which fills the pores and makes the paper suitable for writing and printing. The sizing material used is composed of day and alum rasin or for better preservation property, vegetable based sizing material.

Until the early 19th century, most of the paper was made by hand from rags, which provided long fibres. Few additives were used for processing, primarily because the rags provided fibres in a purer form. The resultant product was strong and durable paper. The old manuscripts which are available in our libraries today, are on this kind of handmade paper, and have as such, survived in a usable condition.

From the mid-19th century, however, increasing demand for paper led to great mechanisation of the paper-making process and the use of raw materials other than the traditional rag. This kind of paper, known as machine-made paper, as distinct from hitherto produced handmade paper, use mechanical pulp, i.e., wood pulp produced by mechanical process. It releases the organic fibres from wood through a mechanical grinding process. The cellular fibres are shorter in length and the pulp contains most of the undesirable substances originally present in the wood, including lignin.To remove these impurities, bleaching agents are added to the pulp. Paper made from this pulp, containing undesirable materials as residue, is short lived and is used for low-quality newsprint etc.

Contrary to mechanical wood pulp, chemical wood pulp, in which the substances which surround the cellulose fibres, including unwanted lignin, are removed by cooking the chipped wood at a high temperature under pressure in the solution, either of Sodium Sulphite (which is acidic) or Sodium Sulphate (which is alkaline). It is then washed to remove lignin and other undesirable substances, Chemical wood pulp has fibres longer and stronger than those produced by mechanical wood pulp, and contains lesser amount of harmful impurities, The alkaline sulphate process is better than acidic sulphate process because in

the former case the alkaline residue in the paper is less harmful than the acidic residue in the latter; from the preservation point of view.

Materials other than Paper: Quality of other materials, ancillary to the production of the artefact (books, periodicals etc.) are also important from the point of view of preservation. The inherent causes of deterioration of paper- based artefacts lie, not only on the quality of paper but also on the nature and quality of other material that constitute the structure and are part and parcel of the artefact. These are: leather, paper, cloth, board, adhesives and thread used for binding. Unless all these materials are acid- free and of desirable quality - these constitute; secondary set of inherent causes of deterioration of the artefact.

As regards remedies to these inherent causes, the librarians do not apparently have much to do. Only thing they can do is to build up public awareness so as to force the book-publishers to use acid-free paper and other materials of standard quality for production of books etc. which are to survive.

Self Check Exercise

1) Discuss in brief the inherent causes of deterioration of paper made from mechanical wood pulp.

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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4.2.2 External Causes

Temperature and Relative Humidity

Prolonged exposure to high temperature is, no doubt, injurious, but exposure to rapid and wide changes in temperature is far more damaging to paper-based artefacts. Rapid changes in temperature cause materials to contract or expand in rapid succession, and the resulting mechanical stresses can cause significant damage and brittleness.

The optimum level of temperature varies according to the kinds of materials that together constitute an artefact. Temperature variation affect each of these materials differently, and should, therefore, be kept as low level as possible, compromising, however, between the comfort of humans working in and visiting the library stack area. Very low temperature should be avoided for another reason. If a book stored in a very low temperature, is suddenly taken out for use in outside environment or for reading under table-lamp, the sudden variation of temperature to which the book is subjected, will be very wide and will be highly injurious to the artefact.

Relative Humidity is an indication of the level moisture content in the surrounding air. This, in conjunction with temperature, is a very important factor causing deterioration. Organic

materials, such as paper, are hygroscopic. They expand and contract as moisture level rise or fall. Therefore, like temperature, it is essential to control the rate of change of relative humidity so that damage is minimised.

A bound volume, made of several materials, all of which expand and contract at different rates, will be particularly affected by changes in relative humidity. Relative humidity below 30% is dangerous because it dries out and embrittles most materials, particularly paper, which will lose its strength and becomes congenial for the growth of mould on them.

The temperature around 20° C + 2° C and relative humidity at about 47% + 2% is generally prescribed. This can be achieved at a level of consistency only by providing air-conditioning facility for the stack area; and if this is not feasible owing to financial and other constraints, the stack area should be kept dry, clean and well ventilated.

Light

Light causes or facilitates photo chemical reaction. Too much light speeds up oxidation of paper and other materials. It bleaches paper and turns it brittle; it bleaches ink, causing fading of the image. Light accelerates chemical reaction with residual lignin in the paper, and causes its yellowing. This phenomenon is more pronounced in paper of the newsprint variety in which lignin residue is more.

Exposure to direct sunlight, which contains ultra-violet rays, causes damage to a great extent at a faster rate. Fluorescent light too is injurious. The absence of any light in the stack-area is generally not harmful; but darkness encourages growth of moulds, fungi and particularly, insects like Silverfish and termites. Moreover library stack-area cannot function in total darkness.

The best way is to avoid direct sunlight, and to use subdued light, preferably yellow. Nevertheless, nothing can substitute the need for constant vigilance in the stack-area.

Atmospheric Pollutants

This menace is more pronounced in urban areas. Major atmospheric pollutants are:

a) TSP - Total. Suspended Particulates - it includes dust, dirt, smoke, soot etc.

b) Oxides of Sulpher - which in combination with atmospheric moisture are converted to sulphuric acid - the arch enemy of records.

c) Oxides of Nitrogen - in the presence of moisture get converted to nitric acid, which is a strong oxiding agent.

d) Oxides of Oxygen - O_2 one which again in a strong oxidising agent.

e) Carbon Monoxide - though harmful for human beings does not have much adverse effect on record materials.

These pollutants react with moisture in the air to form weak acids, which in turn cause paper to deteriorate. Solid pollutants encourage biological actions; these are abrasive in nature; they adhere to paper surface and often increase its acidity, especially in moist condition.

The major methods of controlling deterioration caused by atmospheric pollutants are: filtering of the air intake into storage areas. This can be achieved ideally by air-conditioning. Lack of this facility increases the responsibility of ensuring regular cleaning of books, book-stacks, and ensuring proper ventilation in the stack area.

Biological Agents

Biological agents, such as, moulds and fungi, insects like cockroaches, silverfish, termites, book-lice and beetles feed on cellulose in paper, pastes and glues, gelatin sizing, leather and book-cloth.

All these biological agents thrive in warm, dark, damp, dirty and poorly ventilated areas.

Rodents, rats, mice and other animals cause damage by tearing up paper and binding and by the corrosive effects of their droppings.

All these menaces can be kept under control by:

i) keeping storage areas clean, dry and well ventilated;

ii) maintaining low temperature;

iii) regular dusting and cleaning of shelves, and books, preferably with the help of vacuum cleaners;

iv) maintaining constant vigilance;

v) sealing all cracks and holes in the walls and floor of the stack-area;

vi) carrying out fumigation and other suitable pest-control measures regularly, preferably by entering into annual service contract with reliable pest-control organisation.

Human Factors

Human involvement in causing deterioration and even destruction of library materials is arguably one of the major external factors. This point requires some elaboration, which is being given in the following paragraphs.

Self Check Exercise

2) Enumerate the preventive steps that are needed to tackle the problem of deterioration of library materials from the Biological Agents.

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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4.2.3 Human Causes of Deterioration

Apart from the low standards of book construction and the inherent fragility of the materials from the point of view of preservation, a serious cause of deterioration often is in the casual attitude of the library staff as well as the users of the library towards books as physical objects. The standard of care and handling of books by their custodians and users is often pretty low.

They have very little regard for the physical nature of library materials. They are not always aware as to how to handle, store and use of collections carefully, so as to minimise damage and help preservation.

"Books are for use". This necessitates their constant handling by two sets of people - the library staff and the users of the library. Constant handling by these two sets of human beings is, more often than not, far from ideal. The reason is either the lack of proper attitude or ignorance.

Handling by Library Staff: Books

Library staff do not often have a feeling of genuine concern for physical survival of library materials and do not handle them with tender care which they deserve. The attitude of careful handling does not often come naturally. It must be acquired. It is primarily the staff attitude which is the key to establishing careful handling practices. They need to have a commitment to preservation as an integral part of their responsibilities.

a) *In the Acquisition Section*: The packets of books received from the suppliers is to be opened with extreme care so as to avoid any damage. Each new book should be carefully opened; the pages should be fanned through to often the tension of binding. Uncut pages, if any, should be cut with a blunt paper-knife. Accessioning of the book is then carried out.

b) *In the Processing Section*: Where stamping, labeling and pasting are carried out, both care and elegance are called for.

c) *In Shelving*: Care should be taken to avoid damage. The height of the shelves should be so designed that the shelved books are within easy reach of persons of average-height. The planks should be smooth so- as to avoid damage. The shelves must not be constructed with sharp edges or corners, which could cause damage while taking out or replacing books. The shelves should not be located in area where there is direct sunlight or may have potential danger to the materials. The space above the top edge of a -shelved book should allow enough room to minimise damage to the top of tall items during shelving. Books are best stored upright unless they are tall or wide. Leaning books place under strain on the spines, sewing and edges this makes it essential to use book-supports. Books should not be shelved on their face-edges, as this will cause the text block to pull away from the covers. Books should not be shelved too tight or too loose;

d) *In Transit of Books*: The staff should be trained in the best procedures, and performance monitored. In transporting materials only as many items as can be comfortably managed should be carried at a time. Use of well designed book trolley for transporting materials minimises the possibility of damage. Special care should be taken when transporting rare, precious and delicate items; and also when packing and unpacking books for inter library loan.

e) *In Circulation*: Items being circulated are especially vulnerable to damage. Charging and discharging procedures should be so designed and operated that the wear and tear caused in the process is minimum, if not fully eliminated.

f) *In Photocopying*: Considerable stress is imposed on the material. Bindings suffer most. Spine damage results from forcing pages flat. Thick bound volumes of journals are particularly at risk. These are unavoidable hazards; only proper attention can reduce the damage to only a limited extent.

a) Manuscripts on Paper: should be given special care and treatment before putting them to use. The method originally used in the Public Record Office of the U.K., as outlined by Sir Hillary Jenkinson in his book "A Manual of Archives Administration" is widely used. The process consists of fastening a fine silk net over the surface of the manuscript by means of a carefully prepared acid-free paste made from corn-flour. The finished work is nicely strengthened by a process which is accepted as appropriate. Now-a-days lamination by cellulose acetate foil is used for this purpose in all important depositories of manuscripts.

b) All the manuscripts should be stored in a closed sequence and should not be allowed to be handled freely; to be used by readers only under supervision of the library staff.

c) Periodicals and Serials: The periodicals and serials should be got bound as soon as the set is complete. The paper used for printing periodicals is not always of any good quality. Some items are printed on paper too poor or fragile for regular binding. If such materials are to be retained permanently they may have to be guarded by Japanese tissue or otherwise -protected and bound. Some of the volumes, which pose more serious problems, may have to be placed in cloth portfolios.

d) Pamphlets: The most practical solution for shelving pamphlets is the use of manila folders which can be filed in the Vertical File Cabinets. The frequently used pamphlets should, however, be got bound and properly classified and catalogued as books. Periodical weeding of the out-of-date pamphlets and pamphlets of ephemeral nature should be carried out in order to avoid unnecessary congestion in the files. As an alternative to the use of Vertical File Cabinets, cardboard boxes are often used for storing pamphlets. Solandar Book Box is a well-known variety. There are, however, many other types and designs of pamphlet boxes, which are in use.

e) Paper Clippings: In research libraries, special libraries and Information Centres clippings from selected newspapers are maintained. These are generally mounted on typing paper sheets and are kept in subject-wise sequence in manila folders in Vertical File Cabinets. Periodical weeding is necessary to avoid accumulation of out-dated materials. Some libraries take out clippings of long lasting value and store them, duly mounted, as volumes in a flexible type clip binders.

f) Maps: Some libraries, because of their nature and purpose contain a good collection of maps. Because of their abnormal sizes and the difficulty in their consultation, special stands are prepared and used for such maps, which are mounted. For storing unmounted map-sheets storing cabinets of various sizes, depending on the size of the maps, such as, oversize, regal size, correspondence size, blue-print size etc. are in use. Those map-sheets which are frequently consulted, have to be mounted with cloth back and laid flat in the cabinet of appropriate size. Regardless of the case used, no more maps should be put in a single folder or drawer than can be easily located, removed and refiled.

g) Atlases: Atlases of smaller formats can be shelved on ordinary shelves like books, but the ones which are in larger formats and heavier, require to be shelved in a different way. If these are shelved like books, there is danger of damaging their bindings. Larger atlases should always be kept flat on specially designed shelves.

h) *Bound Volumes of Newspapers*: Some, libraries, to meet their special requirement, keep selected newspapers in bound form. The volumes have to be given strong half leather binding and should always be stored flat. No bound volume should have a thickness of more than 4"; the lesser the better.

Education of Library Staff

Librarians had in the recent past devoted their energies towards providing access to library materials, and towards encouraging use without proper regard for the physical deterioration caused by this increased use. The balance, fortunately, is changing now. The concept of preservation is now gradually becoming a central issue in modern librarianship.

All library staff, no matter where they work, must be aware of the basic principles of preservation and should practice careful handling of the materials and their care. The possession of at least the basic knowledge as an aid to the development of the correct attitude is a matter of adequate training. Preservation as a subject should be invariably included in the curriculum of library schools.

The importance of library staff setting a good example for users to follow in care and handling of library materials cannot be over-emphasised. Staff members should not only be vigilant but also be willing to speak up and intervene when they see library materials are being poorly handled.

All this will require in-house training and orientation programme for the library staff. Moreover, it is also essential to offer opportunities to continuing education in preservation for those whose qualifications need updating or those who wish to build on existing knowledge.

Handling by Users

Failure to respect the physical nature and inherent fragility of library materials on the part of the users poses a constant threat to their longevity. There are certain don'ts which the users should be told. These are, among others:

- Do not pull out from the shelf a heavy volume of book or bound journal by your finger placed on the top of the spine; this will cause the top of the spine to sag and lose its strength.
- Avoid friction while taking out a book from the shelf, or replacing it.
- Books should not be left on the reading table open, face downwards.
- Binding should not be forced in any way.
- Leaning on an open book should be avoided, since this can damage the spine and the binding.
- Corners of pages should not be folded to mark pages, only thin card or paper book-mark should be used for the purpose.
- Avoid licking of finger as an aid to turn pages.
- No rubber bands, metal clips etc. should be used.
- Marginalia of any kind or underlining etc. must be strictly avoided.

User Education

There is an old adage: 'example is better than precept'. If readers find the library staff handling materials with care and tenderness, the practice unconsciously gets transmitted

to them, and they too will behave the same way. If readers find books haphazardly sprawled on shelves, they too are likely to be casual about handling them; but if they find books shelved in upright and neat rows they will tend to keep them that way, and may even straighten up a toppled row to neat order. This is an important user-education imparted by the library staff to the users in an indirect but very effective way.

The library should do well to design appropriate user-education programmes. These programmes need to be presented as appealingly as possible, and should be an ongoing exercise, because library's users are constantly changing.

Apart from the don'ts mentioned above, the user-education programme may include, among others:

- distribution of book-marks with printed message,
- brochures and other hand-outs from time to time,
- attaching printed messages to problem volumes, and special kind of materials such as rare and delicate materials etc.
- issuing posters, signs and exhibits,
- holding exhibitions,
- organising audio-visual programmes as part of orientation session and so on.

Self Check Exercise

3) Discuss in brief the user education programmes that are helpful in maintaining library materials.

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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4.3 STRATEGIES FOR PRESERVATION

Issues relating to preservation have long been well recognised for archival collections, special collections, and collections of large research libraries. It is only during the last one decade or .so that this recognition has been extended to all types of libraries.

Strategies for the preservation of library materials are now being actively developed. These are basically concerned with the following areas:

a) *Determination of Preservation Priorities*

It is realised that we cannot preserve all items in our libraries for all time to come. Priorities for what can or should be preserved and for how long must be judiciously established.

The accepted concept is to make our libraries useful, and we should be concerned with 'preserving materials for as long as they are needed'.

b) *House-keeping*

The house-keeping methods include:

i) introduction of preservation principles into all aspects of library procedure;

ii) orientation of library staff;

iii) training programme for the users;

iv) publication of posters, pamphlets etc. and holding of exhibitions and other mass awareness programmes from time to time to educate the users;

v) implementing a regular maintenance programme which should include maintenance of appropriate physical and environmental conditions (heating, lighting, humidity etc. and over all cleanliness etc.);

vi) disaster response planning - assessment of the causes of disasters like fire and water,

vii) lessening the likelihood of occurrence of such disasters, minimising the damage

viii) imposed, should they happen and salvaging library materials after the disaster happens.

c) *Transfer of Information from Deteriorated Items*

Transfer of contents of deteriorated items in library collections to other more durable media - microfilming and transfer to a digital form (stored on optical discs or computer tapes) are the main techniques used at present.

d) *Cooperative Action*

There are certain areas where cooperative efforts are called for. Some of these are:

i) mass deacidification of books in the library collections within a particular region;

ii) newspaper microfilming projects;

iii) lobbying to force publishers to use non-acidic, alkaline - buffered paper for book production;

iv) establishment of preservation laboratories and centres which can offer their services within a particular region.

Self Check Exercise

4) Identify the broad areas to be considered for setting up the strategies for the preservation of library materials.

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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4.4 SUMMARY

This Unit exclusively dealt with the preservation of library materials in paper form available in different formats such as books, manuscripts, books, periodicals, newspaper, pamphlets etc.

The inherent and external causes of deterioration of different types of paper such as handmade, papers, machine made papers and chemical wood pulp papers are discussed in detail. Remedial measures are also suggested.

In brief this Unit provides an insight into the preservation and conservation aspects of paper made materials in the library.

4.5 ANSWERS TO SELF CHECK EXERCISES

1) Machine made paper use mechanical pulp i.e., wood pulp produced by mechanical process. It releases the organic fibres from wood through a mechanical grinding process. The cellular fibres are shorter in length and the pulp contains most of the undesirable substances originally present in the wood, including lignin. To remove these impurities, bleaching agents are added to the pulp. Paper made from this pulp, containing undesirable materials as residue, is short-lived.

2) Preventive steps required to tackle the problem of deterioration of library materials from the biological agents are:

   i) keeping storage areas clean, dry and well ventilated.

   ii) maintaining low temperature.

   iii) regular dusting and cleaning of shelves and books, preferably with the help of vacuum cleaners.

   iv) maintaining constant vigilance.

   v) sealing all cracks and holes in the walls and floor of the stack-area.

   vi) carrying out fumigation and other suitable pest-control measures regularly, preferably by entering into annual service contract with reliable pest-control organisation.

3) For healthy maintenance of library materials, the user-education programmes may include:

   - distribution of book-marks with printed message.
   - brochures and other hand-outs from time to time.
   - attaching printed messages to problem volumes, and special kind of materials such as rare and delicate materials etc.
   - issuing posters; signs and exhibits.
   - holding exhibition.
   - organising audio-visual programmes as part of orientation session.

4) The broad areas to be considered for setting up strategies for the preservation of library materials are:

a) Determination of preservation priorities

b) House-keeping

c) Transfer of Information from deteriorated items

d) Cooperative action.

4.6 KEY WORDS

Fungi : Type of plant without leaves, flowers or green colouring matter growing on other plants or decaying matter.

Humidity : Degree of moisture.

Moulds : Fine furry growth of fungi that forms on old food or on object left in the moist warm air.

Wood Pulp : Wood shredded and used for making paper.

4.7 REFERENCES AND FURTHER READING

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UNIT 5 NON-BOOK MATERIALS

Structure

5.0 Objectives

5.1 Introduction

5.2 Preservation of Non-book Materials: Basic Considerations

- 5.2.1 Physical Environment
- 5.2.2 Security
- 5.2.3 Circulation Policy
- 5.2.4 Maintenance and Upkeep of Equipment
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- 5.2.6 Handling

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- 5.3.3 Plastic Materials

5.4 Summary

5.5 Answers to Self Check Exercises

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5.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the nature and characters of the materials of which these are composed;
- describe the technology involved in recording information on them; and
- discuss the procedures relating to their care, handling and storage from the point of view of their proper preservation and use.

5.1 INTRODUCTION

We are now in an era in which 'information' plays a role much more vital than even before. In the evolution of our Society the influence of 'information' is growing every day, both in depth and extent. The emergent information technologies today challenge our libraries to respond to this rapid technological change. The libraries can no longer remain unaffected and continue to restrict their scope of activities centering around only the traditional paper based media (which have been discussed. in detail in the preceding Unit).

Consequently, today's libraries are having steadily growing variety of materials, other than paper. These falls under a generally accepted generic term: *non-book* materials. In the earlier days, however, by non-book we meant those media, which were all paper-based, but issued in formats other than of a conventional book, such as, periodicals, reports, pamphlets, newspapers, newspaper clippings, maps, atlases and so on.

That distinction between book and non-book is no longer in vogue because of the invasion of an umpteen number of products printed or recorded in some way or other on materials other than paper, and these non-paper products in today's context are classified as 'non-book'.

This currently used generic term 'non-book' includes two broad categories: *print* and *nonprint*. The non-print media, as distinct from print-media, are those on which printed words or visuals are not directly represented, such as magnetic tapes, digital recordings etc., as against media like films. film-strips, photographs, slides etc. which bear the direct impressions of words or visuals. Non-book materials which are generally available in our libraries today can be categorized as follows:

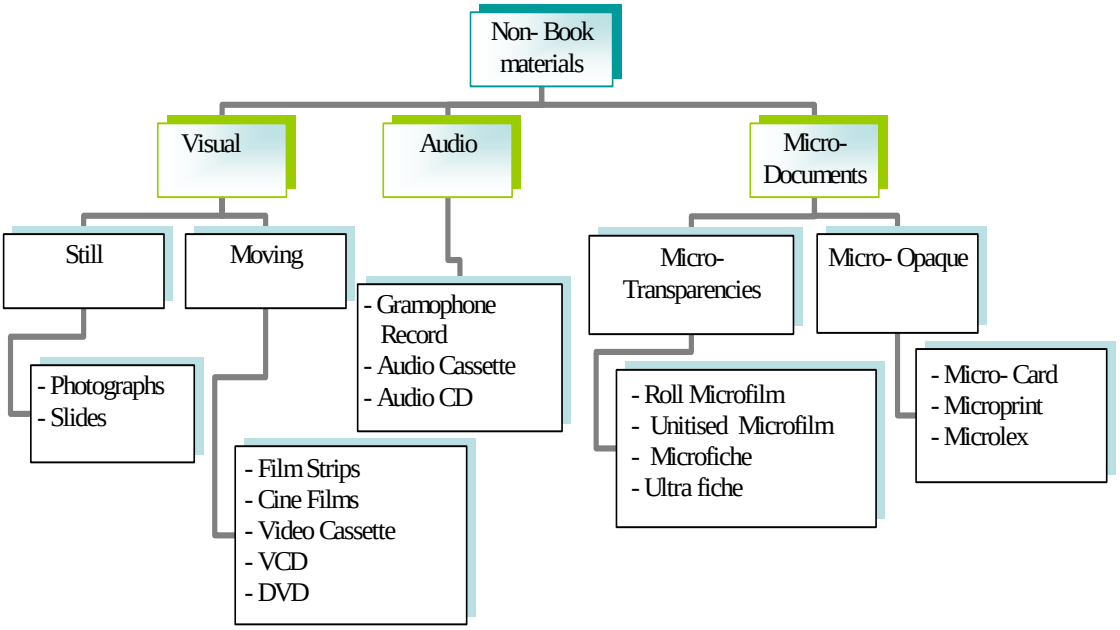

Fig. 5.1: Non-Book Materials in Libraries

In this Unit we will discuss the problems relating to the care, handling, storage, general maintenance and use of some of the more commonly used materials under this category.

Self Check Exercise

1) Categorise the type of non-book materials available in the library.

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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5.2 PRESERVATION OF NON-BOOK MATERIAL: BASIC CONSIDERATIONS

For care and handling of audio-visual materials, various standards, such as, International (ISO), British (BSI), American (ANSI) and German (DIN) already exist. Several of the

audiovisual archives associations have also produced draft guidelines on conservation and preservation. There is, in fact, no dearth of guidelines, but most of these guidelines and Standards deal with storage, fire precautions, specifications for film and photographic bases, and exhibitions. These guidelines are, no doubt, useful, but those can only be taken as non-comprehensive, interim measures. The long-term efficiency of some of these prescriptions is yet to be conclusively established, because the inherent durability of the materials has not yet been fully established.

However, there are certain basic considerations, which are applicable to all non-book materials, as are for book-materials, and are well established principles from the preservation point of view. These are concerned with physical environment, security and circulation.

5.2.1 Physical Environment

Temperature: When dealing with various media formats, no single temperature can be prescribed, because the composition of each of the material is different from the other. However, for the media being considered here, an approximate range can be established. The highest temperature recommended by various authorities for media formats is 75° F for videotapes and cassettes; for magnetic tapes the range is between 65° F and 68° F, while floppy disks can accommodate a range between 50° F and 125° F, though these two extremes are not encouraged.

Ideally, the temperature should be somewhere between 60° F as the optimum for the whole range to media formats and for human comfort.

This temperature range has been prescribed for materials which are being actively used in a library or information centre. For an archival collection, however, a range lower by about 10° F at both ends (i.e., 50° F and 60° F) is generally recommended.

Whatever temperature is decided upon, it is important that it remains as constant as possible. Any fluctuation of more than a few degrees can harm materials. For this reason, the following precautions are needed:

a) the collection should not be stored close to the doorways or windows;

b) Where materials are removed for use from long storage, it will invariably cause temperature variation of more than a few degrees; therefore, the material should not be put to use immediately. A process of 'staging' is required. It enables the item to adjust itself to the changed environmental temperature in gradual steps.

Relative Humidity: Relative humidity is an expression of the moisture content of the atmospheric air. These non-book materials, like all book-materials, are sensitive to this factor. Here again, as in the case of temperature, there is no single relative humidity prescribed for all materials. However, a range of 45% + 5% relative humidity is considered suitable, with 47% as the optimum.

Dust and other Atmospheric Pollutants: No environment is completely dust and pollution free. Measures can be taken to minimise the effect. Air conditioning (which is the only means to control temperature and relative humidity) with filtration systems are beneficial. As further precaution, the materials should always be positioned away from the doorways, windows and vents.

Light: Another environmental consideration concerns sunlight and excessive fluorescent lighting. These factors can be damaging to all types of materials. For example, slides will turn dull and brown or yellow when exposed to too much light; a floppy disk or a phonograph record will become useless in no time, if kept in bright light.

Therefore, the use of non-fluorescent lighting systems, and storing of materials away from windows to avoid the effect of direct sunlight are helpful measures. If, however, positioning near the windows cannot be avoided, the window-panes should be tinted so as to cut off ultraviolet rays of the sun, use of window curtains is also an effective option.

Magnetic Fields: Many materials, such as audiotapes, sound tracks of various media, videotapes etc. are on magnetic tapes or housed in electromagnetic storage devices. The main problems with these magnetic recordings are undesirable erasing of the magnetic signals, separation of the emulsion from the base material, print through, and tape breakage.

Audio and video tapes placed within any magnetic field will either be erased or will develop static charge. The storage location for such materials should, therefore, be in an area free from magnetic fields, any strong magnets or electric motors.

Most magnetic tapes have their own containers, as with audio and video cassettes. These containers reduce damage caused by dust or sunlight. But the problem of magnetism requires that the storage shelves are made of wood or of any non-magnetic metal, free from vibrations and shock. The racks should be electrically grounded, if made of metal, and should be placed away from any electronic fixtures or power lines by a distance of at least a few feet; the farther the better.

5.2.2 Security

The preservation and conservation measures are designed to protect the materials from natural erosion, but security focuses on protection against human problems such as vandalism and pilferage. Therefore, the storage procedure should give serious attention to the security aspect.

It will be necessary to store materials in such a location and manner that these cannot be accessed without assistance from some member of the staff, and are used only under supervision. This is a basic difference between book-access and non-book access. This aspect should receive serious consideration.

5.2.3 Circulation Policy

In order to arrive at a common ground a balance between security and service has to be evolved. This necessitates a well-thought-out circulation policy. In the process of evolving a judicious circulation policy, the fundamental consideration should be, among others:

a) whether or not a particular item should be permitted to leave the library without involving any risk;

b) are proper facilities, available in the library for consultation of all non-book materials in-house;

c) the number of hours the collection is open for consultation;

d) is it possible to identify some items which can be allowed to circulate outside, while keeping the others for in-house consultation only;

e) has the library adequate staff to supervise in-house consultation of all non-book materials;

f) has the particular user, who intends borrowing an item has the required equipment in perfect shape in his/ her personal possession.

A strict in-house circulation policy has certain in-built advantages; but if such a policy is entirely guided by strict security and preservation considerations, it can be considered to be out of tune with the fundamental concept of libraries as user-oriented institutions.

The relation between circulation and preservation is central and at the same time difficult. The purpose of the library is to provide maximum services to its clientele, but loaning out some items means that their usefulness will be shortened. This is a paradoxical situation indeed.

5.2.4 Maintenance and Upkeep of Equipments

Non-book materials like videotapes, films, audio tapes, slides, transparencies, film strips etc. all require additional equipments for their usage. These items are all susceptible to damage caused by improperly maintained hardware. For example, for magnetic tapes tape-players have to be used, the heads of which are to be cleaned and checked regularly to prevent accumulation of dirt and static charge to minimise scratching of the tapes. Phonographic records make contact with the stylus of the player. It is not enough to use only quality stylus, because one of the most common factors contributing to record damage is the dirty or worn-out stylus. The diamond stylus is expensive, yet it is considered worth its cost in view of its preservation value. One way of reading phonograph records is by the use of lasers. With laser discs there is no surface contact; but the laser technology is still rather new and quite expensive. For wider use of this technology the librarians will have to wait a little longer, and till then they have to adopt methods which prolong the life of the records to whatever extent possible.

5.2.5 Storing

It is now generally agreed that non-book materials like phonograph records, tapes, films etc. should be stored in a vertical position. Vertical storage will prevent warping of phonograph records, help protect tapes and films, which are generally damaged by the excess weight on their edges when laid horizontally. Slides and photographs are also best stored vertically. For materials, especially like slides and prints use of individual containers is very important. For photographs the use of acid-free envelopes, made of plastic material is a convenient: method of storing. Plastic resists moisture and will not grow misty with age. Inter-leaved acid-free black paper can help protect them from excessive light.

Cabinet are useful for housing slides, prints, negatives and other materials. The cabinets should be so designed as to ensure easy filing and access.

5.2.6 Handling

Proper handling of non-book materials which are mostly delicate is extremely important. Handling involves both the user and the librarian. The user must know the correct handling procedure imparted to him/ her by the librarian. Before educating the user it is important that the librarian himself/ herself is fully aware of the proper handling of materials, as well as of the hardware used. For this, proper training for them should be designed. For the users, it will be worthwhile to include maintenance brochures along with the materials for their guidance.

5.3 VARIETY OF NON-BOOK MATERIALS AND THEIR PRESERVATION

Keeping in mind the basic considerations applicable to all non-book materials, which have been discussed in the preceding paragraphs, the nature and characteristics of the

various media and general guidelines for their care, handling and storage can be summarised as follows:

5.3.1 Film Media

Photographic film has a layer of emulsion attached to a polyester base material. The image is created in the emulsion by chemical response to light and is fixed there by processing with other chemicals.

The various types of media falling under this category are:

a) **Film-strip:** It is a collection of images which take two different forms: the single or half-frame, and the double - or full-frame. The single-frame strip is usually passed through the viewer or projector vertically, whereas the double-frame strip is projected horizontally. Film-strips are generally supplied in small circular canisters and are accompanied by notes explaining the content of the images in the individual strips.

b) **Slide:** The photographic slide, sometimes referred to as a transparency is a single frame cardboard or plastic frame. Glass is sometimes used to cover and protect the film within the mounting frame. Slides are produced in various formats of different dimensions, starting with 35 mm. and going up to 250 mm square, the latter is suitable for use with the help of an Overhead Projector.

c) **Cine film:** The cine film is a sequence of images. When these images are projected on a screen at the correct speed, the images give the appearance of a continuous movement. The cine films are issued in various formats: 35 mm and 16 mm with sound-track, 16 mm without sound, and 8 mm which is now obsolete (the old stock of 8 mm films have now been transferred on to videotapes or videodiscs).

d) **Microforms:** There are various types of microforms, such as, 35 mm roll-film, 16 mm roll-film; aperture cards; and microfiche. All these types of microforms are discussed separately in Unit 15.

Self Check Exercise

2) Categorise different types of film media.

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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Care and Handling of Film Media

Good care and maintenance of film materials, which are concerned with the following points, constitute the basic procedures for their long-term preservation.

- The films should be changed and inspected after each use. This can be done by using soft brush or puffer. Those items, which are not frequently used, should be inspected regularly and rewound at intervals.
- The equipments used for screening/display must be kept clean and dust free.
- In handling, films should not be jarred or dropped. This may produce scratches.
- Use of bent containers or reels should be avoided. This can damage films severely.
- Films should be handled only by the edges, and should not be twisted.
- Film materials taken out of the air-conditioned storing, should be allowed to reach room temperature before these are screened/displayed.
- Film materials should be projected/ viewed only by equipments mounted safely.
- Only qualified staff should be allowed to handle the media and the equipments.
- Film materials should be stored out of sun-light, which bleaches. In sunlight colours fade with prolonged exposure.
- Films should be stored in dust free containers. The polyester base attracts dust, which damages the film surface.
- The containers should not be composed of materials harmful to film materials, such as those having acidic, sulphur or peroxide contents.
- Glass covering even film may induce formation of Newton's rings if trace of water is trapped between two layers. The rings are rainbow-like effects which change shape with the heat of projection. So, films under glass cover should be absolutely dry.
- High humidity encourages bacterial and fungal growth in photographic emulsions and high temperature affects films badly in the long run. Hence humidity and temperature of the storing area should be as prescribed earlier.

Care and Handling of Microforms

The microforms 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 a permanent life. The microforms require careful handling and sophisticated storage environment. The following are some points requiring careful implementation:

i) Unfavourable environmental condition is a major storage problem and hence, an efficient air conditioning system working round the clock is a must. A temperature of 12-16 degree Celsius and relative humidity of 30-35 per cent provides an ideal storage environment. Since obtaining such lower limits of temperature in tropical climate increases the operational cost considerably, a temperature of 20-22 degree Celsius and relative humidity of 45-50 per cent provides a workable solution.

ii) The microform storage area should be free from dust particles and other contaminants.

iii) Microforms should be stored in closed housings, in drawer type cabinets. The Microforms should not be stacked horizontally, but shelved in the upright, vertical position to prevent warpage. Excessive weight or pressure on the films must be avoided.

iv) Microforms should be covered in boxes, envelops, folders and other enclosures which are chemically stable and free from acid or peroxides. The microform enclosures should be made of acid free paper or plastic. Paper enclosures with slightly rough or matte surface are recommended. Among plastic materials, cellulose triacetate, polyethylene and polypropylene are generally inert and chemically stable.

v) Microforms of different types, such as silver halide and diazo should not be filed at one place. Nitrate based films should not be stored in the same room, where acetate and polyester based films are stored.

vi) Microforms should be handled gently. Finger prints may contain oils, dirt, lotions and other contaminants which can damage images. Careless handling can damage images by scratches and hence the film should be held by its edges. White cotton lint free gloves are recommended for use while handling microforms.

vii) Eating, drinking and smoking should be prohibited in the microform storage area. Boiling of water or otherwise creation of water vapours should also be prohibited in the storage area.

viii) Before using the microforms, the microform reader, reader-printer should be properly inspected and defective equipment should not be used.

ix) The master copies of microforms must be inspected periodically for fungus, brittleness, dislocation and other defects.

x) Deteriorating microforms should be removed from storage area immediately.

Self Check Exercise

3) Write at least two do's and don'ts in care and handling of microforms.

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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5.3.2 Magnetic Materials

Magnetic storage media serve broadly three information management applications, viz. i) data storage; ii) Audio recording; and iii) Video recording. The data storage group of magnetic media is used by the computers, while the other two categories are used by specialised instruments, like audio record-player, video cassette player, etc. This category of materials are available in the form of *tapes* (sound and video) and *discs.*

a) Tapes

Tapes are made of a polyester base to which oxides of iron and chromium are attached. By magnetisation and rearrangement of the magnetic fields borne by these oxides, a message is recorded on the tape. This message (whether sound or video) can be 'read' by

a device in the playback machine. Magnetic tapes used for data storage are read by special drives attached with the computers.

Magnetic tapes: Magnetic tapes are the oldest of all magnetic media. The magnetic tapes vary in width from 4mm to 0.5 inches. It may be packed on open reels, in cartridges or cassettes of various size and shape. The commonly used open reel tape measures 10.5 inches in diameter and contain 2,400 feet of tape. Thinner tapes are also available with more footage of tape in the same 10.5 diameter reel. The storage capacity varies with linear recording density measured in bytes per inch. Depending on the recording density tapes are available, that can store 150 megabytes to 1.35 gigabytes of data. The IBM 3480 magnetic tape cartridge introduced in 1984 is a convenient and compact medium that records data on a half inch magnetic tape storing 200 megabytes of data in, 540 feet space. The cartridge measures, 4" x 5" x l" size. Digital Audio Tape (DAT) is now being used to store backup data from servers and computers. They are comparatively small in size having a dimension of 7.2 x 5.4 x 1 cm. and width of 3.8 mm. They come in the form of cartridges.

Audio tapes: Audio tapes are available in two types of format: open reel and cassette. They are available in various playing speeds and recording formats viz. monoaural, stereophonic, and quadraphonic and have tracking configurations like 2 track and 4 track.

Video tapes: Video tapes are made of chromium dioxide or metal as the major constituent of the magnetic coating. In 1971, Sony Corporation introduced the first video recording U-matic system to use magnetic tape cassettes. The U-matic tapes measure 3/4 inch in width. In 1975, Sony introduced Betamax recorder using 1/2 inch video tape cassettes. This video cassette measure 6.1 inches wide by 3.8 inches high by 1 inch deep. In 1977, the Victor Company of Japan introduced VHS video cassettes. The cassette size is 7.4"x 4"x 1". The VHS video cassettes are identified by a code indicating recording time in minutes, when the recorder is operated at the normal play condition. The common length of VHS cassettes are T -120, having a two hour run time. Later on two other VHS version of video cassettes have been developed. They are: Super- VHS (S- VHS) and VHS-Compact (VHS-C). The image of S-VAS is of high quality and the cassette measure 4"x 2.5"x 0.5" in size. Now 8mm tape video cassettes are available in the market. A higher version of this Hi8 cassettes are used for digital recording. These cassettes measure 3.7"x 2.5"x 6" and the tape length varies from few minutes to more than one hour.

b) Discs

Magnetic discs are used with computers. They can be categorised as hard disk and floppy discs. Hard disks are stored within the computer service area.

Floppy disks: The floppies used for recording digital data for computers are thin circular plastic sheets. These are usually covered with ferric oxide, like magnetic tapes. These discs are supplied in card or plastic covers, from which these should never be removed. Some discs are supplied in completely sealed containers. The density of information packed on to the recording surface is very high. Considerable effort is needed to protect it from any damage.

As with magnetic tape, the degree of proximity between the head that records or reads the data coded magnetically, and the disc *is* extremely important. On this depends the accuracy of reading. It is, therefore, essential that dust and dirt do not gather at all on the head and the disc. It is also essential that the magnetic surface is not touched by hand and

is kept covered as far as possible. Any greasy material picked up when touched by hand is disastrous.

Floppy disks are still most widely used magnetic media, because of their easy portability and the facility for saving and deleting files as and when required. Nowadays only 3.5 inch diskettes having 1.44 megabyte of storage capacity are available. Other formats viz. 5.25 inch and 8 inch are now obsolete.

Hard disks: Hard disks are high performance storage media having application in on-line and rapid access to data. A hard disk is made up of a stack of rotating metal disks on which data are stored. These are usually fixed inside the computer and hence are not physically accessible to the users. This implies that the care and maintenance of hard disks are performed by the hardware engineers and users are only required to know the operating procedures. Also, as the magnetic media rotate at a very high speed and data are read and recorded by a magnetic head. It is more vulnerable to damaged due to head crush or other hardware malfunctioning.

Stability of Recorded Information

Stability of recorded information in case of magnetic tapes has been reported to be between 10-20 years. Whereas, the life span of a video cassette is more than 20 years. As such, magnetic media are considered medium-term storage media having life span of 10 years. As discussed previously, stability here denotes the period of time during which a given medium permits reliable recording and retrieval of information. Reliability is determined by absence of permanent read/write errors in the recorded information. Error-free operation denotes one error per trillion recorded bytes (12.2 gigabytes). The magnetic media are vulnerable to accidental erasure by magnetic field, improper handling, inter-layer transfer, media wear and environmental effects.

Erasure: In magnetic media, such as disks and tapes, recorded information can be erased by application of an opposing magnetic force of sufficient coercivity. Coercivity is defined as the field strength required to accomplish demagnetisation of the medium. It is measured in units called "Oersteds". The potentiality of accidental erasure is enormous as many office instruments and products are having magnetic properties. However, to completely erase information, the strength of a magnetic field must exceed the coercivity of the magnetic medium on which the information is recorded. The coercivity of a small bar magnet commonly encountered in homes and offices is 550-650 oersteds. Many commercially available magnets exceeds 700 oersteds coercivity and are so small that can be concealed in a pocket. Coercivity value of some magnetic recording materials is given in Table 1.

Table 1: Coercivity value of magnetic recording materials

Material	Coercivity value in Oersteds
Premium grade magnetic tapes	270-330
Magnetic tape coated with ferric oxide	270-420
IBM 3480 tape cartridge	490-550
Cobalt surfaced VHS video Cassettes	620-720
Super- VHS video cassettes	900
8mm video cassettes	1500

Media wear: Heavy use of magnetic media results in wearing of both media and read/write heads. The magnetic coating of the tape or diskette accumulates debris and hence recording and playback is affected adversely. Wearing of magnetic media and read/write

heads occur due to adhesion, abrasion and corrosion. Adhesive wear particularly occurs when the magnetic media and read/write head is in prolonged stationary contact. It is very common in video cassettes due to continuous replay of a particular frame. The abrasive wear occurs when a hard material slides over a softer surface. It produces scratches on media. Corrosion results from oxidation or other chemical actions and increases abrasive wear.

Inter-layer transfer: The magnetic field of the media may effect its own part and this is called inter-layer transfer. When magnetic tape, cartridges and video cassettes are wound, flux line from one layer of tape can migrate to adjacent layers causing transfer of recorded signals. It is usually common in audio-cassettes having long wavelengths, representing low and mid frequency signals.

Self Check Exercise

4) Write at least three sentences on Stability of Magnetic Media.

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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Care and Handling of Magnetic Material

The stability of recorded information in magnetic media is vulnerable to damage due to its inherent magnetic nature as well as due to various external conditions and events. Inadvertent erasure can lead to loss of vital information. Inter-layer transfer and wear can effect the usability of the media. Similarly, careless handling and improper storage would damage recorded information. There should always be 2 copies of magnetic media-one storage copy and the other working copy. Information content of hard disks should also be kept as backup. The following are some points on storage and care of magnetic media requiring proper implementation:

i) The magnetic media storage area should be properly air conditioned with a temperature of 17-20° Celsius and relative humidity ranging from 35-45 per cent. The temperature and humidity should be constantly maintained round the clock.

ii) Magnetic tapes should be enclosed in polyethylene bags. Similarly audio and video cassettes should be kept in plastic containers.

iii) The storage area should be dust-free, as very small dust particle can make portion of magnetic media unreadable.

iv) Storage area must be cleaned using vacuum cleaner.

v) Magnetic tapes and diskettes should be shelved in the upright, vertical position and should not be stacked horizontally.

vi) Magnetic media should be handled gently. Information recorded space of the media should not be touched as finger prints, skin oils etc. may damage information.

vii) Eating, drinking and smoking should be prohibited in the storage area. Boiling of water or otherwise creation of water vapour should also be prohibited in the storage area.

viii) Magnets should be strictly prohibited in the storage as well as working area of magnetic media. While in transit at least 3" should be maintained between magnetic media and external magnetic fields.

ix) Direct sunlight must be avoided to fall upon magnetic media.

x) Keep the magnetic media inside their container, while not in use.

xi) Do not write directly on a diskette. Use previously prepared adhesive label.

xii) Use write protect tabs, to prevent the inadvertent over-writing or deletion of information recorded on floppy disks.

xiii) Equipments that are used in utilising magnetic media should be properly handled.

xiv) Magnetic media should be subjected to periodic rewinding to avoid accumulated stress on tapes for long term storage.

xv) Periodic checking of magnetic media should be done for corrective measures.

xvi) For longer life of magnetic media, periodic copying on to new media at regular interval is recommended. However, in case of audio and video cassettes, this may result in loss of image and or sound quality.

5.3.3 Plastic Materials

Materials under this category can be divided into three sections:

- Transparent plastic
- Vinyl discs
- Optical Storage System

Transparent Plastics

These are flat, transparent acetate or polyester sheets and are available in various thickness commonly ranging from 0.05 mm to 0.25 mm. These are available either as single flat sheets or in rolls.

These sheets are used for projection with the help of overhead projectors. The text can be written on them by using special quick-drying ink. In addition, self-adhesive film and letters can be attached to the surface. These plastic sheets can be printed also by photocopiers, laser printers and other standard printing processes.

Vinyl disc

It is composed of a strong plastic material on which audio recordings are made. The discs are marketed in 17.8 cm (7"), 25.4 cm (10"), and 30.5 cm (12") diameter size. The disc has a central hole which fits with the spindle of the turn-table. The inter-table provides for 33 1/3, 45 and 78 revolutions per minute (RPM).

Optical Storage Systems

This technology is most commonly used in producing *Compact discs* (CD). The disc is made of plastic material. On the plastic surface there is a spiral of pits backed by an aluminised reflective surface. The surface is protected by a strong transparent lacquer. The recording is either an analogue or a digital version of the original. In either case the presence or shape of the pits is 'read' by a laser beam reflected from the mirror-like surface. In this process of reading there is no physical contact with the surface of the lacquer. As such, no damage can occur through using the disc. Different versions of Compact Disks available in the market are: CD Audio, CD-ROM, CD-V, CD-I, CD-R, CD-RW.

The Digital Versatile/ Video Disc (DVD) is the new generation of optical disc storage technology. It is replacing laser discs fast as it has the capacity of holding 28 times more data than CDs. DVDs are available in variety of formats: DVD-ROM, DVD-R, DVD-Video, DVD-R/RW, DVD+R/RW, DVD-RAM, DVD-VR, DVD-AR, DVD-SR and DVD-A.

Care and Handling of Plastic Materials

Plastic sheets are not generally used for any long lasting purpose. So long as the document printed or written on them are in need, the sheets are kept flat to avoid wrinkles. These are kept free from moisture to avoid sticking together. If several sheets are kept together one above the other, it is necessary that these are separated by sheets of paper kept in between.

On the other hand, the plastic material from which disc is made, is fairly strong. The major care which the disc will need is to protect the groove on it from dust and dirt, and to clean the surface, as well as the stylus of the player before using the disc each time. The pick-up stylus physically vibrates along the groove as the disc is played. As a result, the grooves gradually wear out. This is a natural process of decay. The less number of times a disc is played, the longer it lasts. Use of worn-out stylus quickens the process of decay. So the use of such a stylus should be strictly avoided.

Careful handling of discs to avoid their dropping down or scratching on their surface is essential. The discs should be as level as possib1e on the turn-table, when played.

Bending and warping due to exposure to heat and damp are very common. Such damage may also be caused as a result of uneven pressure on the surface.

Discs should, therefore, be stored in controlled temperature and humidity. Each individual disc should be placed in the paper sleeve, the opening of which should be against a sealed edge of a cardboard cover in which it is placed. The discs, so covered, are stored vertically, not leaning in either direction. It is not advisable to stack several discs together, stacked one above the other.

Though optical storage media can withstand high wear, proper storage condition and handling is essential for their life span. The stability of optical disks mentioned above are in an office environment, but environmental precautions are necessary as oxidation and corrosion may destroy the protective layer and subsequently damage encoded information. The potential damage to optical disks can be minimised by carefully implementing the following points:

i) Optical disks require minimum climate control and can be stored in temperature between 5-50 degree Celsius and 10-90 per cent humidity.

ii) Storage and work area should be regularly cleaned. Disk drives should be cleaned before use.

iii) If rewritable optical disks are stored, magnets should not be allowed in the storage area.

iv) Optical disks should be kept in their plastic cartridges. Shelving must be done in a vertical, upright position. Heavy objects should not be kept on the top of optical disks.

v) For removing dust from the disks, a soft, lint-free cloth should be used and wiping must be done in a circular motion from the centre to the outer edges.

vi) Optical disks should regularly be visually inspected for corrective action.

vii) Optical disks containing valuable information meant for long-term storage should be copied from time to time to increase their estimated life span.

viii) All equipments used for optical disks should be in proper operating conditions. Defective instruments should not be used and be repaired immediately.

5.4 SUMMARY

In this Unit, the preservation and conservation of non-book materials e.g., film media, magnetic materials and plastic materials are discussed in detail.

The basic consideration for the preservation of non-book materials such as physical environment, security and circulation has been discussed.

Finally, the care, handling and storage aspects of different types of non-book materials have been discussed individually.

5.5 ANSWERS TO SELF CHECK EXERCISES

1) The categories of non-book materials available in the libraries are:

a) Visual

i) Still photographs, slides, etc.

ii) Moving - Film-strips, cine films, video cassettes and disc.

b) Audio

i) Sound recording, gramophone record, compact disc (CD),

ii) Digital audio technology (DAT), Audio tape, audio cassette.

c) Microforms

2) The different types of film media are:

a) film strip

b) slides

c) cinefilms

d) microforms

3) Do's:

i) Microforms should be stored in air conditioned room having temperature of 20-22 degree Celsius and relative humidity of 45-50 per cent.

ii) Keep microforms in closed drawer type cabinets and shelve them upright in a vertical position.

Don'ts:

i) Do not store nitrate based films and acetate/polyester films together.

ii) Do not touch information content area of microforms. This may damage the information.

4) Magnetic media are non-archival storage devices having stability of recorded information between 10-20 years. The magnetic media are vulnerable to accidental erasure by a sufficiently coercive opposite magnetic force. Also, inter-layer transfer, improper handling, media wear and environmental conditions can considerably effect the stability of information in magnetic media.

5.6 KEY WORDS

Non-book Media : The generic term used for different types of non-paper media such as magnetic media, optical media, film media etc.

Stylus : Sharp needle tipped with diamond or sapphire used to reproduce sound by setting in the groove of a record as it turns on a record player.

Warping : Bending or twisting or distortion of materials.

5.7 REFERENCES AND FURTHER READING

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