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MLIS-VIII E-1

Module 1 Concept of Preservation and Conservation of Library Materials

Module 2 Different Types of Library Materials

Module 3 Enemies of Library Materials

Module 4 Control of Deterioration—Preventive Measures and Housekeeping

Module 5 Binding and Preservation Unit

Unit 1 ❑ Need for Preservation

STRUCTURE

1.0 Objectives

After reading this unit you will be able to :

1. understand the concept of preservation and conservation.
2. know the role of the librarian in the preservation of library materials.

1.1 Introduction

The purpose and objectives of libraries may be divergent but the basic condition of the libraries is their role in the society as medium of communication. The library materials constitute the processes of communication and libraries, whose function is to store and make them available from the total system of communication. Libraries operate with one purpose that they will exist to facilitate the process of communication. The role of libraries has been expressed by Herman H. Fussier in this way, 'A distinguishing

feature of modern culture of non-primitive civilisation is its dependence on the written word as the principle device through which, (1) the knowledge over time is recorded for the future, (2) the state of contemporary knowledge and ideas is communicated, and (3) the knowledge of the past becomes available to contemporary man. If this is true, or even approximately true, the critical role of the library in relation to the advance and to the preservation of modern civilisation becomes obvious, for the library is the major social organisation that systematically acquires, organises and preserves, that makes the activities described above possible, and its role is a major one in connection with the communication of contemporary knowledge as well. The impact of library materials as medium of communication has been recognised in any, society, primitive and modern. It is important that vehicle of intellectual contribution should be preserved in all seriousness and fairness to make them availble whenever asked for.

The first unit introduces the subject "Preservation and Conservation of Libary Materials" It is the responsibility of the librarian to preserve the collection of the library in his custody in a good and usable condition. For this purpose the librarian should have an adequate knowledge of preservation and conservation. This unit presents a general outline of the different methods and techniques of presevation and conservation.

1.2 Concept of Preservation and Conservation

Preservation is the umbrella term now applied to a wide variety of collection management responsibilities, intended to preserve collections of print and non-print materials for.future generations.

Conservation concerns with the physical and chemical treatment of materials to retard their further deterioration. The purpose of conservation is to stabilize an object and to maintain it as close as possible to its original condition, not to attempt to restore it to resemble its orginal condition. Conservation as a profession has evolved from the craft of restoration. In common parlance 'preservation' concerns with the maintenance aspect and 'conservation' with the remedial treatment, and restoration of the original condition.

1.3 Librarian's Responsibility

The art of preservation materials is as old as human civilisation. In a way it may be said to derive from the instinct of self preservation, common to all animate beings. Documents have existed in one form or another since men invented the art of writing, and it was quite natural for mankind to attempt to preserve them. There are various types of media which have been used through centuries to carry ideas of information. There are media made of inorganic substance, and media created by modern technology. Books at present are the major constituent of library. It is the social responsibility of the librarian to keep all the books physically fit to be used by the readers at any point of time whenever required.

Preservation is a part of every librarians's responsibility to ensure that people present and future, will have access to the information that constitute the documentary heritage. Knowledge of materials and preservation become more and more important in managing library collection, which will be indispensable to human evolution, knowledge and creativity.

1.4 General Approach to Preservation

Preservation of a document in a library, be it a manuscript or printed book or in the form of a non-book specimen, we think of the three components which constitute it :

(a) The physical entity (the artefact)

(b) The impression of the physical entity (the image)

(c) The thought content (the information)

1.4.1 Preservation of the physical entity and the Impression

Practically the physical properties arising from the base materials and their composition in construction of the physical entity of book and other library materials create problems of preservation. The physical entity of a book is compared of various types of paper, board, leather, thread, ink, adhesive, etc. Each of these materials is susceptible to natural decay, and deterioration are caused by various phycial, chemical and biological conditions by atmospheric and environmental situation. These are the cases where the art-fact is in an unhealthy condition. In extreme cases these become almost useless. Here we have used the generic term 'book' to include other reading materials. Deterioration of the physical entity and the impression on it is caused by the interplay of three basic factors :

(a) Inherent characteristics of the library materials

(b) The storage condition of the materials

(c) The intensity of handling of the materials by the climate

(a) Inherent characteristics of library materials of the early writing materials, the most common were birchbark and palm-leaves. Birchbark better known as Bhujapatra, was the most popular of all early writing materials. It was nothing but the inner bark of the tree called Bhurja that grew plentifully in the Himalayan regions. Birchbark was cut into pieces of different dimension, generally one yard long, and as broad as outstretched fingers of the hand, or somewhat less according as the writer required and liked. In order to make its writing surface hard and smooth, it was rubbed with oil, and polished, and then written upon with a reed pen and ink specially prepared for it. Such leaves were then held together with a string through their middle portion, which was left unwritten. The compact book was then fastened to two wooden boards.

Palm leaves or Tala-patra is of two varieties : tala (palmyra) and sritala (talipot). Leaves of tala do not absorb ink, and stylus was used to inscribe characters on them. The leaves of stritala are thin, flexible and can be written on, like paper. Both birchbark and palm leaf

are natural organic materials and these possess inherent strength to withstand normal environmental effects for many centuries, if stored poperly. The layers of birch bark tend to separate over a long period of time and the edges of palm leaf and birch-bark show a tendency of curling up, if exposed to prolonged dryness. Prolonged dampness is also responsible for their gradual deterioration.

(b) Paper

The largest single constituent of library materials is book. There are also various types of non-book reading materials. All these materials both in book form and non-book form are composed of paper. Mainly paper and other constitutent of the book create perpetual problem in preserving.

Paper is a thin tissue of any fibrous material, the individual fibres of which, after being separated mechanically and suspended in water, are then matted into sheets by dipping into water suspension and lifting the fibres out. Paper can be made from animal fibres (wool, fur, hair, silk), mineral fibres (asbestor), synthetics (rayon, nylon, glass, etc.) and even ceramic, stainless steel and other metals, but it is normally made from the plant fibres (cotton, esparto, straw), wood, flax, hemp, bamboo, jute and many other reeds). The cells in plant fibres are rich in cellulose, a white substance insoluble in water carbon and oxygen. In paper manufacture the beating process is very important. If beating process is not done properly the paper will be deteriorated. Much water is used for paper manufacture. If the water is not free from iron, mineral and other impurities the paper manufacture will be deteriorated shortly. The alkalinity of the paper and the natural strength of long cotton fibres, commonly used, contributed toward greater strength and are responsible for the longevity of the handmade paper. But the machine-made paper produced since mid-nineteenth century use mechanical wood pulp and acidic chemicals for processing for the search of economy and speed of production. For acidic content the paper loses flexibility, splits, and turns yellow and brittle in a shorter time. The causes of deterioration of paper made during that period cannot be detected by seeking a book. It will be realised after the damage is iione to some extent. Modern practices and manufacturing techniques have made it possible to obtain good quality paper from any fibre.

(c) Binding

Boards are used for making hard cover binding. Today's boards are usually made of paper and these are available in many weights and sizes. When these boards are exposed to atmospheric condition they deteriorate quickly. These are used as food particularly with starch glue, by insects, also as hideouts and breeding place. Leather provides the major strength and durability to library binding. Synthetic materials have been used recently with increasing frequency, either in place of leather bindings, which are expensive, or for the protection of cloth binding. Synthetic rubber adhesives have an important role in commercial book binding (that is, manufacture of paperbacks) where low cost, good binding strength, flexibility, but not long life, are required.

Whatever may be the method of bookbinding, the life of a book depends on the thread and other sewing materials apart from the paper. The leather and rexine may be used for

binding though these are not always of any prescribed standard. The workmanship is also concerned with good binding. In a loosely bound book, p'ag*.., may be separated from the binding. Too tight binding encourages the reader to damage th~ spine of the book by random and ruthless handling.

(d) Other materials

Besides the paper of any type, other library materials are audio tapes and discs, films and photographies, magnetic tapes, electronic media.

The base of audio tapes is cellulose acetate, polyvinyl chloride, mylar and the like. The base of audio records may be shellac wax, cellulose nitrate, cellulose acetate, polyvinyl chloride, styrene or the like. Ail these elements used as base consist of high molecular weight organic compounds. These elements are produced by heat pressure, evaportation of solvent, or by the use of plasticizers. These elements are thermoplastic, which are repeatedly softened when heated, and hardended when chilled. The base elements of all these materials are susceptible to damage by environmental condition, particularly in tropical zone.

1.4.2 Preservation of Information

Preservation is a part of every librarian's responsibility to ensure that people, present and future, will have access to the information that constitute the documentary heritage. If the preservation of the artefact is not possible for certain consideration, the last way to preserve the image is by facsmile reproduction or microfiliming. Knowledge of materials and preservation become more and more important in managing library collection which will be indispensable to human evolution, knowledge and creativity.

1.5 Summary

In this unit we have discussed the basic point about preservation and conservation. Preservation is a part of librarians' responsiblity We have pointed out the components in the general approach to preservation. The physical entites of books and other library materials have been highlighted. It is also the responsibilty of the[1] librarian to ensure access to information contained in the library materials.

1.6 Exercise

1. Explain the concepts of preservation and conservation.
2. Indicate the need for preservation in libraries.
3. What role does librarian play in preserving the library materials?

1.7 References and Further Reading

1. Chakrabarti, B. and Mahapatra, P. K : Library Collection : selection and preservation, World Press, 1991.
2. Mahapatra, P. K. and Chakrabarti, B : Preservation in libraries : perspectives, principles and practice, ESS Publication, 2003.
3. Ranganathan, S. R. : Physical bibliography for librarians. 2nd ed., Asia Publishing House, 1974.

Unit- 2 ❑ Evolution of Writing Materials

STRUCTURE

2.0 Objectives

After read ing this unit you will be able to :

1. know some important materials which had been used for writing during the period of early civilisation
2. get an overview of early writing materials used in India
3. have some basic ideas about paper which is the most important writing material all over the globe today

2.1 Introduction

Early writing materials were many and varied. The history of writing and the civilisation was there in Mesopotamia, at present known as “Iraq” on the land between two rivers, the Tigris and the Euphrates, more than seven thousand years ago. The land was known as Sumer. The first human habitation was there with settled life, agriculture produce, domestic animals and social bondage, meaning a family and social life.

Historians believe that our ancestors started communications by using some signs and symbols on sand. But sand could not carry written impressions for long, nor could the message impressed on it be transported from one place to another. So began the human effort to search for suitable writing material.

2.2 Writing materials of the past

2.2.1 Stone and Metal

Probably the first writing material was stone, the frist writing an insciption and the first pen a chisel. Indeed, the earliest writing material was rock or a stone on which rude scratchings were at first traced by scribes and then actually cut by stone-cutters who probably had no idea of their meaning. These rock or stone inscriptions seem to have been the world’s early writing the evidence of which is still found on the pyramids in Egypt and on hill sides, columns and pillars of stone in India. The instrument with which this writing was done was a metal tool called chisel which had a sharp edged end. The **Rosetta stone** of Egypt which is more than 5000 years old, is one such example. Metal plates for writing purpose were introduced at a later date. But as the stone blocks were rather heavy and could not be carried from one place to another, the need of something lighter and more portable than stone as writing material was felt and as a result bricks or clay tablets came to common use at the hands of the chaldeans, a Semitic tribe that flourished in ancient Babylonia.

2.2.2 Clay Tablets

In the history of mankind the Sumerians were the first people who invented and developed the writing system, the records of human mind for themselves and for the posterity. The first written records were the records relating to property, accounts and temple administration. The records were made on clay tablets mainly. The Babylonian people and the Assyrian people also used clay tablets. The library of Borsippa and the library of King Ashurbanipal collected many clay tablets. The tablets were made of soft clay and writing was made on them with sharp instruments. The soft clay tablets were dried and hardetsned by baking like bricks. The records were the royal documents, contracts, grants, code of laws, religious hymns, history, science, literature and the like. Clay tablets bore a style of writing known as cuneiform writing. The wedge shaped stylus which was used for writing on soft clay invariably created wedge-shaped makes and these wedge-shaped characters represented the typical style df cuneiform writing.

2.2.3 Papyrus

At a time when the Balylonians were creating clay tablets with cuneiform writing, the Egyptians began to leam to make beautiful writing material from papyrus plant. In fact, the ancient Egyptians discovered a light, soft and convenient material for writing known as papyrus. The clay tablets were heavy and inconvenient to handle. Papyrus was manufactured in Egypt from the stem of flowering plant which was available abundantly in the Nile valley. The stem of the plant is 3 feet to 10 feet in length, triangular and tapering in shape. The papyrus as writing material, had to undergo a series of steps for preparation. The papyrus plants were collected and the stalks were cut into length of about 12-16 inches. The soft pith of the plants were then slit into thin strips and were laid flat side by side. A second layer of these strips was then laid over the first layer at right angles. Then the two layers were treated with gum-like solution and pressed, pounded and smoothed until the surface became suitable for writing. Papyrus was used as writing material about five thousand years back and was in vogue for four thousand years. The ink used was black and red, and thick point pen or reed pen was used for writing.

Alexander the Great established the famous library of papyrus books at Alexandria. At present, the largest collections of papyri is that of the Archduke Rainer in Vienna, Egyptian literature was mostly written on papyrus. The Book of the Dead' is perhaps the earliest Egyptian book, a copy of which has been preserved in the British Museum. Papyrus remained in use right upto the 11th century, but gradually it was supplanted by parchment and vellum. Probably it was no longer available in plenty needed for book production.

2.2.4 Parchment and Vellum

Parchment was equivalent in older language to vellum but in strict modern use there is a difference. Except that both are animal skins, they are equal neither in quality nor in the texture, not in the methods of their preparation. Vellum is a finer material than

parchment and is prepared in a different way. Papyrus plants were not available outside Egypt and the export of papyrus was restricted. An alternative to papyrus was sought for; parchment became the substitute and succeeded papyrus as a writing material. Though parchment was used as early as 1500 “B.C., it did not gain popularity and extensive use until the beginning of the Christian era. Parchment has probably taken its name from the city of Pergamum which was then the centre of its trade.

Parchment was the skin of animals-usually goat or sheep. To make the writing material as parchment, the skin was treated, tanned and processed like leather. Skin has two sides, the hair side and the innney side, the inner side was used for writing surface. Parchment was first used in Asia minor as writing material. From time to time the processing of skin was improved for splitting, tanning and bleaching. The material was durable than papyrus and was lighter too. So it became popular. Parchment was widely used as the writing material by the fourth century A. D. in Europe. It had an impact over the style of writing. Because of its thin, smooth and durable surface broad-pointed pen was used for writing instead of reed pen.

Parchment, however, proved to be a better medium for writing than papyrus and hence it was more expensive because it was smooth on both sides, stronger and more durable. Parchment with two smooth surfaces ensured the development of a form of book called codex, where sheets were written on bothsides and stitched together to form a book. This-form replaced the roll form.

Vellum is also animal skin but not of goat or sheep. It is. the calf-skin. Vellum as its name implies (old French velin (vel which means calf) is a writing material made from the skin of newborn calf. Vellum, when treated and processed,.gave finer, smoother and whiter surface than parchment did. It requires much treatment before its surface can be written upon. After cleaning it in a long exposure in lime it is stretched in the sun and dried and rubbed smooth with pumice-stone. The finest vellum known as **Uterine Veilurn** was made from the small skins of calves which were unborn or died at birth. It was used only for the most expensive manuscripts. The oldest Illuminated manuscript written on vellum is the Virgil which is now in the Vatican. Many books written on parchment and vellum have been preserved and housed in different libraries of the world.

2.3 Writing Materials in India

India has a glorious, heritage of writing materials. It has been traced that writing was in about five thousand years back. The civilisations of Mohenjo-daro and Harappa created some sort of scripts on the seals which have not yet been deciphered. The Indus valley clay seals, sealings and pottery were the materials on which writing was made. Writing materials commonly used in ancient India were of two kinds : (i) some were durable and more of less permanent while (ii) others were perishable by nature. To the first group belonged such matials as stone, copper, iron, gold and silver while to second belonged such soft and perishable materials as birch bark, paim leaves, cotton and silk cloth and so on.

2.3.1 Stone

Due to its durable and lasting nature stone was used as writing material from ancient times. The great emperor Asoka issued many rock edicts and pillar inscriptions. Usually there were palled *Silalipi* and *Silalekha.* When rough stone was used for writing purposes, the ground was often prepared by rubbing and polishing before writing was incised. A good scribe or artist then wrote the text with ink or dye on its smooth surface, which was then incised by an engraver. Complete literary works were also written sometimes o'n stones. Dramas written by Chauana King Vigraha IV and his court poet Somadeva arc found carved on slabs of stone at Ajmer.

2.3.2 Birch Bark

Birch bark better known as Bhurjapatra was the most popular of all early Indian writing materials. [The birch trees grow abundantly in the Himalayan region.] The inner bark of the trees available in the form of sheets were cut'into appproriate sizes and used for writing. In order to make its writing surface hard and smooth it was rubbed with oil and polished, and then written upon with,a reed pen and ink, specially prepared for this purpose. Such leaves were then held together with a string through their middle portion which was left unwritten. The compact book was then fastened to two wooden boards, which not only protected its leaves but also served as its get-up.

Birdi barks were used from the time of Alexander's invasion down to the Mughal period. The earliest specimens are the *Kharoslhi Dhammapada* from khotan and Border Manuscripts. A few manuscripts on birch bark belonging to the 15th or 16th century A.D. have come from Kashmir and found shelter in different libraries in India and abroad and a few more are still found in Kashmir, Orissa and other parts of India.

2.3.3 Palm-leaf

Palm-leaf or talapatra was a very common writing material all over India in ancient and medieval times. According to Rajasekhara there are two kinds of palm leaves. One is *tadipalra* for writing with pen and ink, which is the common practice in northern India, the other is *ialadala* for incising with metal stylus, the common practice in south India. The former variety is called sritala and the latter, tala. Sritala leaf is thin, flexible and can be handled like paper Tala leaf is thick. It does not absorb ink and therefore, characters had to be inscribed with stylus. One of the most ancient Buddhist works-the *Tripitakas* was written on palm leaves. The palm leaf manuscript of Godfrey collection was written in-fourth century and the Horiuzi manuscripts in sixth century. The length of palrri leaves may vary from one feet to three feet and the width varies from one inch to four inches. The leaves are to be treated by water and dried for several times and finally to be polishd to make them suitable for writing surface.

There were two ways of writing on palm leaf. In south India and Orissa the letters are

incised with the sharp-pointed stylus in the form of dots. While the holes are made in the size of letters, coloured ink or charcoal was applied to these holes to make the writing as visible letters. In northern India simple writing was made on the palm leaf like the writing on paper. In Orissa, palm leaves were cut into various non-conventional sizes to make them artistic crafts.

The use of palm leaf as a writing material, however, declined only with the introduction of paper, nevertheless it is used even now in the country-side by the beginners in the primary schools for writing the alphabet.

2.3.4 Cotton and Silk Cloth

Cotton and silk clothhad also been in use in India for writing purposes since.ancient times. It was then called ‘Pata’ or ‘Patika’. A silk band containing a list ofjain sutras written with ink was discovered by Buhler at Jaisalmer and a manuscript of the Jain work.

Dharmabidhi written on cloth dated 1361-62 A.D., was found by Paterson at Anhilavad Patan. But manuscripts written on cloth or silk cloth prior to this period have not survived mainly because such materials could stand neither the onslaught of weather, nor the onslaught of moths and Worms.

2.3.5 Skin

As the ancient Indians did not like to write the ‘immortal word’ on such impure materials like skin except that of tiger, and deer, skin was used very sparingly for writing purposes. There is, however, reference to it in some Buddhist works as also in a Sanskrit work, *Vasavadatta* by Subandhu, that skin was sometimes used as writing material in those days. Though very few manuscripts on skin are found in India to-day, that should not lead us to the conclusion that the use of skin as a writing material was universally condemned. As other writing materials like leaf, tree-bark, cloth, etc, were abundantly available, the use of leather was largely disfavoured. About a dozen documents on leather written in Kharosthi were, however, discovered by Stein in Chinese Turkistan, which proved beyond doubt that it was used at times as a substitute for other varieties.

2.4 Paper

Paper is the most inexpensive and convenient writing material used all over the world with the development of human civilisation and culture, The prime advantages are that, paper is light, easy to handle and to transport; it takes minimum space to store and need not depend directly on nature for its supply. Paper can be manufactured easily according to desired specification. Although paper was invented in 105 A.D. in China, it took centuries to make use of it as medium of transmission of thoughts. But as soon as the people learned the manufacture of paper in quantities, it become universally accepted writing material. Paper replaced all other writing mateirals because of its many advantages. In particular, the invention of printing by movable types made the paper essential and

indispensable material as vehicle of printing. The enormous multiplication of the number of copies of documents and the exponential growth of literature were possible only with the paper, the most convenient material. Since then, we have been living in the age of paper.

In India paper first come to Gilgit in Kashmir in the sixth century. There are not much evidences of using paper for writing duringthe following centuries. The craft and trade of paper making, spread from Kashmir to the south in Punjab. Sialkot was one of the earliest places for paper making after Kashmir. Paper making, then, went to different places like Lahore, Delhi, Multan, Muthura, etc. During the Mughal period, paper-making was in the highest esteem and various kinds of paper were manufactured. Paper-making became an object of art.

The paper used for writing the manuscripts was handmade paper. The early paper mills were not mechanised. The handmade paper was used. The first paper mill was established in modern India in 1711 at Tranquebar. The first paper mill in eastern India was set up in 1825 at Serampur.

2.4.1 Materials of Paper

Paper is primarily composed of cellulose fibre from the vegetable product. The raw materials are disintegrated and reintegrated in water through various processor. The primary raw materials and other materials may vary for the manufacture of different kinds of paper. But the cellulose fibres of the primary raw materials determine the quality and longevity of paper; certain chemicals are used for various purposes for the manufacture of paper. Such chemicals often affect the quality and longevity of paper. The primary raw materials are given below :

Cotton has ninety one percent cellulose content and it is considered to be the best raw material. High quality paper is made of cotton materials. But cotton, in original, is not used for the manufacture. Cotton fibres are longer as well as stronger. Cotton rags, cotton linen and other cotton-produced materials are used for paper-making :

Another material with stronger and longer fibres as the hemp. There are a number of varieties of hemp cultivated almost all over India. The particular type of hemp used for paper-making is called sans or sunn. Another type is jute. But sans is lighter and stronger than jute. These are used for durable and special type of paper.

Flax is used in India and this material has longer and stronger fibres. Flax is called atasi or tisi. The plant is meant for oilseed. But the plants are good raw materials. This material is stronger enough to be pounded. Stampers are used for a long time. This is prepared with potash and lime by keeping the mixture for some time. It is used for superior kind of paper.

Another primary raw material is wood.The demand of paper is so high that raw materials in bulk are to be used. Wood pulp is used for this purpose. The cellulose content in wood is slightly more than fifty percent. This pulp is used for ordinary paper. The pine fir, birch and such other soft-wood trees are used at their young age. There are two kinds of good pulp, mechanical and chemical. Mechanical wood pulp is derived from the saw dust with its impurities. In the process of chemical wood pulp, the wood is cut into pieces and

boiled with chemical reagents. It is thus devoid of impurities. Paper produced from chemical wood pulp is better than that from mechanical wood pulp. Among other materials bamboo grass, paddy and wheat straws, etc. are generally used. Paper made from chemical wood pulp is comparatively strong and does not fade soeassily. Such paper is generally blights and whiter than paper made of machanical wood. It is largely used for the printing of evefy-day books.

For a century now, these raw materials have been in use in paper-making. The other raw materials essential for paper manufacturing are dyes, of various kinds, rosin, and alum for surfacing purposes, China clay and titanium oxide as loading agents.

2.4.2 Manufacture of paper

Since the very eariy days, paper has been manufactured by hand, a manual method. Later machanical methods have been applied and machines are used in large paper mills to manufacture huge quautity of paper as required by the human society. But the methods of paper-making and the processes attached to them have been changed very little since the early days. The broad outline of paper-making is that the raw materials are disintegrated, pounded and reintegrated with water in the form of pulp, stretched over wire mesh or mould forming sheets of thin layers, and dried by whole operation is done manually and for the machine-made paper the processes are performed machanically for output in large quantities.

2.4.2.1 Handmade paper

From its invention in 105 A.D. to the year 1798 when machine process was invented by one Nicholas Louis Robert, all paper was made by hand. The raw material such as linen rags, hemp, plants, etc. are cut into prices and pounded for a long time, then the material is macerated in water. The material, then, kept in a cloth is tied up and placed in water of flowing river or pool to cleause and remove impurities. Some kind of alkaline solution is mixed up with this material and then pounded to make it in the form of pulp. When the pulp is ready, it is mixed with warm water and constantly stirred with a pole till it is ready for paper making in a large tub or vat.

The mould is wire mesh having a frame for strengthering the borders. Over the top of this frame, fits another called the deckle which restricts the area of the mould over which the pulp can flow. The deckle usually determines the size of the sheets of paper. The mould with deckle is plunged into the vat full of liquid pulp perpendicularly and then turned to a horizontal position keeping a thin layer of pulp over the mould. The mould is lifted up with a soft layer and moved in one direction, then moved in another direction in right angles. This process makes the fibres of the pulp move both the directions and thus strengthen the paper, interlocking thefibres. It is a delicate and subtle craft and it is upon this the strength of the paper chiefly depend. While the sheet is dried to some extent and matted, the deckle is removed, the uneven edge of the paper is known as dickle edge’. When the sheet is more or less in a solid form, the mould is faced down, or a piece of woollen cloth or felt. Another felt is placed over the sheet of paper. The next sheet of paper is kept over the felt. In this way a pile of sheets of paper is kept within felts, separated by them.

The pile of paper is pressed by a screw press to drain as much water as possible from the pressed repeatedly, to give them a smooth surface. The sheets of paper are finally dried by hanging four or five sheets together over hair cords. Single sheet may wrinkle, soanumberof sheets are placed.

The next process is to give it a non-absorbent surface, on which printers of writing ink will not run. For this it has to be sized. It means the sheets of paper are dipped into a gelatinous liquid, then pressed and dried. The fibres of the paper are kept behind the gelatinous cover making them non-absorbent. The sheets of paper are finally pressed and smoothed by conch-shell or stone piece and are given glazing. Now the paper is ready for Use.

A very important point regarding paper-making is the 'Water-mark.' It depends oh mould. The mould may be a Maid' mould made with fine close wiremesh having thick wires at intervals. The 'Wove'' mould is made with fine wiremesh closely woven. It does not have the thick wire metting. Handmade paper is usually 'laid' paper, prepared in laid mould. These wire lines can be seen as whiter and more transparent than othe portion if seen against the light. The watermark may also be seen in a pattern if in the mould, the wires are twisted or soldered. The paper-makes and the manufacturing place may be identified by the watermark. The watermark is particularly useful in determining format, in dating theundated work. Therefore, Watermark is very important tool for the collation of the books and an important tool for historical bibliography. The first known example of a watermark has been found on paper produced about 1282.

2.4.2.2 Machine-made paper

The methods of paper manufacture are almost the same both in manual process and machine process. The change that has been made in the later process is the application of machinery in paper manufacture. The paper-making machinery was invented by Louis Robert in 1798 in France. The machinery was introduced in England by Henry Fourdhiier.

At the first stage the raw materials-rags, waste paper wood, bamboo, grass, hemp, etc. according to the kind of the paper, are cut, sorted and dusted. The raw materials are boiled in large vessel with water containing alkaline reagents. Thus the non-cellulose materials are separated and the impurities are removed. The mechanical wood is grinded and washed by constant flow of water and the chemical wood cut into slices is boiled in water with alkaline solution. Usually calcium bisulphite, magnesium bisulphite and sodium sulphate are used according to requirement.

The pulp, then, goes through the 'breakers' to separate fibres from each other by the Hollander machine. Then the pulp moves to another machine for 'beating'. At this stage the sizing materials and filling materialsfor loading are added to the pulp. At t his stage bleaching is also made. While the processed pulp is in the machine to produce paper, it is placed on an endless belt of wiremesh to flow continuously. The belt of wiremesh is constantly shaken from side to, and moves forward. The water in the paper drops out and the thin sheet of paper is on the wiremesh belt The sheet, then, with a roll of felt, goes through steam-heated drying rollers. These rollers have double actions. The rollers press the sheet and evaporate the moisture of the sheet. While the sheet is stronu enough, it is

detached from the felt, roller, and continues to go through further drying rollers. Then the sheet is pressed for smoothness and finish As regards finish, this can be done in a variety of ways. Papers can be either machine-finished or super-calendered or machine glazed. Machine finished paper requires no further treatment and as such, is directty sent for use. But papers that require a still smoother surface are passed through a supercalender machine that has eight to twelve rollers arranged one below the other, those in the middle being covered with cloth or paper and the rest heated in steam. The pressure and heat of the rollers thus impart to the resultant sheets a very fine and smooth surface, a gloss and sparkle.

2.4.3.Paper Size

The size of a book depends on the size of the paper used, because the sheet of paper is folded for several times to make the format of a book. In a library the sizes of the books are very important factor for shelving, storage and other aspects of library administration. There are some over-sized books such as, atlas, books on art, reference tools, medical and engineering books, etc. The height of the book shelf depends on the size of the books to be kept The normal sizes of the books are 8 vo of demy and crown. A slightly bigger sizes are 8 vo of royal and imperial. The sizes of paper sheets and the sizes of 8 vo as book sizes are given below in inches.

	Sheet	Double	8vo
Fool Scape	$13^1/_2'' \times 17$	$17'' \times 27''$	$6^3/_4 \times 4^1/_4$
Crown	$15'' \times 20''$	$30'' \times 20''$	$7^1/_2 \times 5$
Demy	$17^1/_2'' \times 22^1/_2''$	$22^1/_2'' \times 35''$	$8^1/_4 \times 5^1/_5$
Medium	$18'' \times 23''$	$23'' \times 36''$	$9 \times 5^3/_4$
Royal	$20'' \times 25''$	$40'' \times 25''$	$10 \times 6^1/_4$
Imperial	$22'' \times 30''$	$30'' \times 44''$	$11 \times 7^1/_2$

As regards ordinary papers 24 sheets as a rule form a quire and 20 quires form a ream. Most calculations are based on units of 500 sheets in a ream. The weight of the paper is expressed in GSM (grammes per square metre of a sheet).

2.4.4 Certain kinds of paper

Usually the books are printed in white wove paper known as white print of various weights according to thickness of paper. Now-a-days expensive books are printed on a paper known as map litho, a glozed and smooth white paper. There are also some special kinds of paper either made of some special materials, or given some special kind of finishes. Such papers as China paper, India paper, Japanese vellum, etc. are made of some special materials, or given some special kind of finishes. Such papers as China paper, India Paper, Japanese vellum, etc. are made of some special materials, which Antique or Feather wright paper, Art paper, etc. are given some kind of finish.

(i) China Paper : It is a kind of paper made in China from bamboo fibres. It is a fine soft brownish paper which gives fine impressions of engravings. It is sometimes known as **Rice** Paper.

(ii) India Paper : It is very thin and strong paper. It is made of fine rags and opaque for judicious loading. Sometimes it is known as Bible paper.

(iii) Japanese Vellum : It is made of Japanese shrubs. The paper is very delicate and used for engravings. Its surface is smooth and creamy-white like vellums.

(iv) Antique Paper : It is a rough surface paper and light weight in comparison to thickness of paper. This paper is not durable.

(v) Featherweight : This paper is very rough and puffy, it picks up dirt easily, often clogs the type in the printing press, occupies needless space on the shelf, and is easily cut by the binding thread.

(vi) Art paper : It is a super glossy paper coated with china clay or similar materials. This paper is used for printing of halftone blocks particularly coloured. The durability is poor and ‘easily damaged by moisture.

(vii) Blotting Paper : It is a kind of unsized paper for drying ink. It is very soft and absorbent. Blotting paper of superior qualtity is generally made of cotton and hemp.

2.5 Summary

This unit highlights the materials used for writing from early civilization til! date in India. In the early days stone, metal, clay tablets, papyrus, parchment and vellum were used as writing materials. Later the typical Indian materials such as birchbark, palm leaf, textiles, wooden boards, metal plates were extensively used. Finally paper has become the principal writing material of the modern society.

Composition of paper, ingredients of paper, handmade and machine made paper have been discussed in detail. Finally paper size and certain kinds of paper have been indicated.

2.6 Exercise

1. Mention important early writing materials used for centuries.
2. Indicate the early writing materials used in India.
3. Describe the ingredients of paper and its varieties.
4. What is water -mark ?
5. When machine-made paper was invented ?
6. Discuss the manufacturing process of machine-made paper.

2.7 References and Further Reading

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Unit 3 ❑ Paper Documents

3.0 Objectives

After reading this unit you will be able :

(1) to know the composition and ingredients of paper documents which constitute largest single constituent of library materials
(2) to know the process of paper making longer
(3) to have an idea about the modern paper with longer durability

3.1 Introduction

Paper exists in many different forms, but the common underlying feature is that they all consist offlbrous elements bounded to one another. Although in the late twentieth century there are rapid advances in the electronic storage of information, there is no doubt that paper will continue to be widely used because of its relative cheapness and convenience.

Much of one existing stock of information and other aspects of cultural heritage is in the form of print on paper, which needs paper care and preservation.

The largest single constitnent of library materials is book. There are also various types of non-book reading materials. All there materials both in book form and nonbook form are composed of paper. Mainly paper and other constituents of the book create perpetual in preservation. So we should take of composition and ingredients of paper.

3.2 Composition

A paper like sheet can be made from many different types of fibre, but virtually all the paper encountered in libraries is made from naturally occurring vegetable fibres freely inter-twined with each other in water in such a way that a sheet is formed. The fibres are the bone structure of the plants from which they are obtained and when they are treated with caustic soda in order to remover their juices and natural colour, they are reduced to cellulose which is the best constituent of all papermakirig. The strength and durability of paper naturally depend upon the length of fibres of which it is made and its quality is dependent on the original material from which it is cellulose is derived. The most important unifying feature of conventional papers is as follows: on dispersion in water, cellulose-based fibres absorb moisture and become swollen and pliant. When a mat is formed by driving the suspension through a fine, flet wire mesh, the wet fibres tend to be otherwise in layers parallel to the plane of the wire, but otherwise in more of less, but not quie random directions. On drying this wet, a profound change takes place. A special type of chemical bond the hydrogen bond-forms in the regions where fibres overlap and make contact. This self banding is the key to producing a coherent strong, stiff sheet of paper. No extra adhesive is required and paper can be made simply by drawing wit cellulose fibre and allowing the web to dry.

Today most of the paper produced contains fibres derived from wood. The remainder is mostly made from vegetable fibres such as straw, bamboo.

3.3 Ingredients

The principal ingredients of which paper is generally manufactured are cotton and linen rags, esparto, straw, hemp, bamboo and wood. Of these cotton rags yield the purest cellulose and therefore, the finest grades of paper are made from them. Their fibres are nearly an inch long on the average, very fine and strong. Rag paper can stand a good deal of wear and tear and can retain the original colour for several years without showing any sign of fading. They are the most durable of all papers,

Linen rags yield also high-quality cellulose. But linen is very scarce, it is often mixed with cotton for making ledger paper and thin bank paper and is hardly used as the sole material of paper-making.

Esparto or alfagrass is a strong bladed grass that grows in North America and South Spain, It is neither strong nor durable as it has dry short fibres whose length does not exceed 1.5 mm. It cannot retain the colour for a long period. It has, however, a fine smooth and clean surface and can be suitably used for writing and printing. It is chosen for the body of art paper.

Straw came into common use at the hands of paper-makers for making ordinary printing owing to the paucity of suitable quantity of esparto during the second world war. Hemp is used fo'f making thin but opaque paper. It is very expensive, it is sometimes used in printing the Bibles and the prayer books.

Bamboo is largely used for manufacturing paper in India. As its fibres are short and brittle, good paper cannot be made from it.

But wood is the principal raw material of paper through-out the world. It has fifty percent cellulose content. It however, produces ordinary paper. Trees such as spruce, pine and fir yield best fibres, whatever variety may be chosen as the raw material, it is reduced to pulp prior to paper-making.

This pulp is of two kinds-mechanical wood pulp and chemical wood pulp. Mechanical wood is ground in water into saw-dust instead of being chemically disintegrated and as a result it retains all the impurities the inter-cellular matter. Hence paper made from mechanical wood lacks strength and turns brown and brittle under long exposure to light. Chemical wood on the other hand is better from ofwood pulp. Here the wood is cut into pieces, usually about an inch square. These pieces are then reduced to pulp by boiling them in water with soda or sulphite, which removes impurities, but keeps length and strength wood is, therefore, stronger and does not fade so easily. Such paper is generally whiter than paper made from mechanical wood. It is largely used for the printing ofbooks.

3.4 Processing of Raw Materials

The early paper-makers produced lasting and durable paper. Early papers were produced by stamping or beating hemp, linen rag and ropes in mortars, with water until a smooth paste of fibres was obtained. The paste was then diluted with water to a suitable consistency, mixed thoroughly and poured over a linen fabric stretched on a wooden frame mould. This mould was kept in constant vibration in all directions to ensure that the fibres were distributed uniformly. The greater part of the water filtered through, having a thin layer of wet and matted fibres on the fabric. This matted fibre sheet was dried in the sun and then detached from linen fabric base and cut to size and flattened. Latter moulds were made of bamboo strips tied together with silk threads. Samples of paper so made are still in good condition; some of there are almost white, while others have discoloured with the passage of time. This process of paper-making has not yet changed, the modern hand-made paper manufacturing technique employs a wooden mould with brass wires lead in parallel or woven across the frame. The newly formed sheet is stripped form the mould when slightly wet to economice on the number of moulds in use. The paper formed in this way is sized

with animal glue or starch to provide greater mechanical strength arid the required surface characteristics. The size prevents the ink from feathering on the paper and acids in the bonding of fibres.

Paper continued to be made from pure rags until the 17th century—the use of new and strong rags was confined to the best grades of writing and printing papers, while worn and discoloured rags were used for manufacturing inferior quality of paper.

Towards the end of the 17th century, the demand for paper became great and soon the supply of new white rags was insufficierit to meet requirements. As a result, rags of all kinds were treated in various ways to produce fairly white stuff for making paper, and the quality deteriorated. During the nineteenth century, even the linen wrappings'of the ancient mummies of Egypt were sold for the purpose. Many of the rags and wrappings were of low physical strength, quite a few contained almost every type of foreign matter, some of which was washed out (luring the paper-making process. The indiscriminate use of chlorine as bleaching agent is one ofthe factors in the deterioration ofthe quality of paper. The blueing of paper made of yellowed and deteriorated rag is another, bluing tender the yellowed paper a relatively white appearance and made it possible to use low-grade rags for the production of writing and printing paper. The use of alum as a moderating agent resulted in paper which was acidic in nature,

3.4.1 Handmade paper

From its invention in 105 A.D to the year 1798 when machine process was invented by one Nicholas Louis Robert all paper was made by hand. Handmade paper used raps, the cleaner the latter, as its source of vegetable fibre. The rags were soaked in water and then beaten to flatten the fibres, the soaking swelled the fibres and promoted their chemical bonding and the beating flattenned fibres and caused the separation of fibres. The general procedure has always been to make a pulp, dip a mould in the pulp and bring it to the surface laden with fibres, and mat the \fibres by shaking as the water drains out ofthe mould. The newly formed wet sheets are then laid in a pile and more water squeezed out before drying sheets on boards in the sun or by hanging them in a drying room. The paper sheet is formed through several kinds of bonding : mechanical bowding through the fabrilles tangling together, chemical bonding of cellulose molecules, and surface tension between fibres. The sheets, at this stage between felts, were stacked and pressed, then removed from the felts and air dried. Sizing was added by dipping the paper sheets into gelatine or animal glue to give them non-absorbent surface-they were again dried, smoothed and glazed.

3.4.2 Machine made Paper

Papermaking by machine is essentially the same process, but fully mechanised in a continuous sheet matter, than in single sheets. A moving screen scoops the slurry, which goes through various stages such as drying, calendaring (passing through rollers to give the paper a smooth surface), sizing and glazing. Machine-made paper is characterised by fibres

which are aligened in the direction in which the screen moves whereas hand-made paper has no grain. The machine by which the paper was first manufactured is called the fouridinier which was first patented in 1798.

Increasing demand for paper led to greater machanisation of the papermaking processes. Subsequent improvements in technology have been such that once logs enter a modern paper mill, they are reduced to a pulp, cooked, treated with chemicals picked up in continuous sheet on drums, coloured, sized, dried and packaged for delivery by a continuous automated process.

3.5 Modern Paper

Most paper made in modern days is imparmanent. Its-life is measured in decades rather than in centuries. To last for longer time paper should have permanence and durability.Permanence is the ability to remain stable and resist chemical action with from internal impurities or the surrounding environment. Durability is defined by the degree to which paper retains its original strength, especially under conditions of heavy, sustained use, If paper is to survive for any length of time in libraries, it should be strong on it in library collections.

Modern methods of papermaking can produce paper as permanent and durable as that made by earlier methods by using long fibres, by removing all chemical residues left from the pulping process, by using acceptable sizing and by removing all bleaches from it. Generally, paper for library use should be made from chemical wood pulp.

Paper quality declines owing mainly to the increased use of alum-rosin sizing and mechanical wood pulp which raises intrinsic acidity levels. Acid is also introduced into paper by residual chemicals used for bleaching, by some types of ink, air pollutants and acid transfer or acid migration. Much acid comes from polluted atmosphere, with car exhausts a major source. The effect of this acid on books is particularly noticeable in the discolouration and brittleness on the edges of pages. It is mainly caused by sulphur dioxide (SO_2) in the air with metallic impurities in the paper to form sulphuric acid (H_2SO_4). Nitrous oxide (NO_2) which reacts to form nitric acid (HNO_3), is also present in polluted atmosphere and has been identified as another source of deterioration of library materials. The presence of lignin in paper is also not conducive to its permanence.

The most important measure-of whether a paper is permanent is its PH, a measure of the acidity or alkalinity of solution taken from it. PH is measured on a logarithmic scale from O to 14, with O being totally acidic, 14 being completely alkaline, and 7 being neutral.

To obtain a finished paper of the desired properties a number of variables have to be controlled and taken into consideration. These include the type of fibre used, the extent of cooking and. bleaching, and the degree of bonding between fibres which determine to large degree the physical properties of paper. The amount of fibre treatment, formation on the wire, the amount of wet processing, methods of drying and theamount of calendaring affect the degree of bonding.

Modem practices and manufacturing techniques have made it possible to obtain good quality paper from any type of fibre. Modern machine made paper is to be classified in

terms of its use. One those most frequently encountered by librarians is news-print which is mostly machine finished ground wood pulp. It is not intended to last long and it begins to deteriorate iti a few months. Book papers are made of inexpensive chemical wood pulp in a wide range of wt ghts and finishes. They are intended for text books and others of short life expectancy. Text papers are designed for high grade printing such as expensive books, booklets and brochures. They are appreciated for their texture and attractive colours and because of rather stiffsizing, are better suited for offset printing than for letterpress. Cover papers are similar to text stock, but are heavier. As their classification, they are primarily for booklet covers and come in a wide range of U. tures, colours and special finishes. Bond paper, commonly used for better and business forms, often shows up in libraries in typed manuscripts.

The advent of the halftone process and the printing of illustrations in colour necessitated the development of china clay or coated papers. The paper normally used for book work was not smooth enough even when calendared, and super-calendared for the new printing processes. To have clear impressions china clay mixed with barites was added to the wet pulp. The resulting glossy, smooth, glaring, white material was excllent for the fine printing but for bookbinders and librarians, it was a disaster. Although 10% clay was sufficient for excellent illustration and art work, these ‘art papers’ were all too often made with for higher percentages of filler. Consequently some are little more than sheets of clay supported by a skeleton of wood, straw and espart fibres. This paper is difficult to bind and feeing hygroscopic is easily damp stained. Furthermore, it sticks together when stored in humid atmosphere for any length of time.

During the last six decades, paper technologists have made perceptible strides in improvement of the quality and appearance of machine-made paper. An event of particular significance to librarians has been the development of a permanent durable wood pulp paper that is guaranteed to have a life span of hundreds of years. The wood permanent here stands for the property of paper to retain its original characteristics. The wood durable means resistance to deterioration by use.

3.6 Special kinds of Paper

There are some kinds of special kinds of paper—either made of some special materials or given some special kind of finishes. Such papers are Japanese hand made paper, China paper, India paper, European handmade paper and the like.

Japanese handmade paper considered by some to be the finest in the world, are produced by craft techniques that have not changed in hundreds of years. They are made by farmers as part-time occupation in remote mountain villages where there is a plentiful supply of water and of natural vegetable fibres. Strength and permanence are the chief characteristics of these sheets. The most common vegetable fibres used are a wild mountain shrub : Kozo, a tough sinewy shrub of the mulberry family.

China paper is a kind of paper made in China from bamboo fibre. It is a fine, soft brownish paper which gives fine impressions of engravings.

The so-called rice paper of the Orient is not a true paper nor is it made from rice. This material, so well suited for Chinese paintings, is cut spirally from the pith ofFormosa and (Jaiwan's) Fatsia papyrifera. The sheets of pith when first cut and dried are quite brittle, but when saturated with water, become tough and somewhat pliable.

India paper is a thin, soft abosorbent paper of Chinese or Japanese origin which is used in taking the finest proofs called India proofs, from engraved plates. It is made of rags and rendered opaque by judicious loading. This paper is thin but tough and is used for printing the Bible when it has got a new name Bible paper by which it is sometimes-known. It is suitable for printing pocket editions.

Antique paper, though known by the name 'Antique' has little resemblance to old paper. In its extreme form it is called Featherwight. It is a very rough paper and is very light, composed with its bulk. This paper lacks strength and absorbs dirt easily due to its fluffy surface.

Art paper is a quality paper—its basis material being a web of esparts which is not loaded but coated with china clay satin or pearl hardening. These substances which are coated on the surface of the web are mixed with such adhesives as glue or casein of gelatine and are then compressed on to the surface of the web by rolls. As an adhesive, casein is much better than gelatine because the former is insoluble while the latter sets up decay. This paper has a shiny surface necessary for printing fine half-tone blocks. It however, suffers from serious drawbacks and hence it is unsitable for public library use.

European handsome paper, although lacking the variety available in those from the East, are generally excellent. Some of these are produced in mills, most of these mills only pure rag pulp made from the finest linen and cotton rag. The rags are cleaned by boiling, followed by raising in clear water when bleach is used. Great care is exercised to eliminate residual chlorine. Although there have been many refinements in the preparation of the pulp and in the later pressing and drying of the sheets, there is still no substitute for the paper. European handmade paper have been shrunk naturally and their behaviour when wet is most predictable. They are excellent for restoration of old volumes and for luxury printing but are not suited for modern boolcmaking. "Blotting paper is a kind of unsized paper for drying ink. It is very soft and absorbent as it is not sized. Its cheap variety is made of chemical wood pulp. Blotting paper of superior quality is generally made of cotton and hemp and it can suck up not only a considerable quantity of wet ink but can also absorb it quickly.

Bond paper is a kind of unglossed paper which is used for typing as also writing letters and correspondende.

Tissue paper is a kind of thin, soft, unsized, white or coloured semi-transparent paper used for wrapping or protecting delicate articles, engraving in books.

Decorated papers are used for book covering and end paper fall into three categories-marbled,' paste and printed.

Hand marbling is done today almost exactly as it was hundred years ago. The combinations of haves and design obtainable are infinite.

Paste papers were often made by early bookbinders in their own shops. These “pulled” papers were made by applying coloured paste to the surfaces of two sheets of paper, placing, them together face to face and then pulling these apart. Variations in designs were obtained by rubbing the backs of the sheets when they were together or placing string or other objects between pasted sheets

Printed paste papers were more professional and required more elaborate equipment. In making these, coloured paste was applied to a sheet of paper and then a metal plate or wood hiock impresed on it When the block designs were cut in relief the design forced the paste through the paper.

3.7 Durability of Paper

The durability of paper depends not so much on how it is made as on what material is used. That is whv Dard Hunter in his book [“ Paper Making’, 1947] has noted that “the preparation of he stock rather than the method employed in its formation influences the life and durability of paper, be it by hand or by machme’VPaper practically started to deteriorate in respect of both quality and permanence since the introduction of such raw materials as esparto, straw, mechanical wood pulp Hence papers made from them become weak and brittle and turn brown so soon. Paper made before the introduction of power into this industry retained their strength and durability for a long period. Some of the causes of deterioration of paper are as follows :

(a) Some of the machines for paper making damage the fibres during the process of manufacture

(b) Paper manufactured by, machine obtains strength in one direction only in which the fibres interlock as a result of the shake of the machine in that direction

(c) Excessive bleaching causes damage to fibres.

(d) Excessive mineral loading brings about decay

(e) Fibres of straw and esparto are very short and meehanicai wood, ground up as it is, has no length of fibre and they yield inferior paper, which fades so soon

Paper manufactured from cotton, flax and hemp is the most durable of all papers. Next to it, in respect of pennanene, is the paper made from chemical wood Grade I paper is all rag paper made by hand or machine If absolute permanence is desired, paper should be made of white; cream or unbleached iinen of cotton rags of best quality without adding any mineral matter in, loading, and it should be hand-made and tub-sized with gelatine.

3.8 Summary

In this unit we have discussed the ingredients and composition of paper documents in libraries. The paper making process has been discussed in detail D efferent kinds of paper have been highlighted.

3.9 Exercise

1. How would you obtain gcod quality paper?
2. How would you measure the acidity of paper ?
3. Why does the paper quality decline?
4. Distinguish between hand-made paper and machine made paper.
5. What are the principal ingredients of paper?

3.10 Keywords

1. Japanese Paper: A highly absorbent, strong, quality paper made from plant fibres.

2. Kraft Paper: A tough, strong paper made entirly from woodpulp

3. Machanical wood Paper Cheap paper made by grinding raw wood into pulp (newsprint). All impurities and acid substances remain in the paper, causing its deterioration.

Nawsprint : A generic term used to describe paper of a type generally used in the publication of newspapers. It is usually of a high groundwood content;

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Unit 4 ❑ Physical Elements of Book

STRUCTURE

4.0 Objectives

After reading this unit you will be able to :

1. know that books are more or less kept permanently
2. know the different physical elements that constitute a book.
3. understand that knowledge of the structure of book is essential for librarian in order to take appropriate curative measures

4.1 Introduction

Items in library collections are complex objects. They are usually constructed from a combination of many materials. A book may consist of paper, inks, boards, adhesives, covering material and sewing materials. Another point that must be kept in mind that not every thing that libraries collect was manufactured for permanent retention. Newspapers are the classic example of this. In earlier unit we have discussed paper along with its chief ingredients. Here we shall highlight other physical elements of book.

4.2 Inks

Indian ink, simple suspension of lampblack in gum was used as early as 250OB.C. It makes permanently indelible marks on porous writing surfaces, because the gum suspension, the material and the carbon ink was widely used for writing in the west until the nineteenth century, and still it is preferred for fine calligraphy. It has always been the favoured writing fluid in the East. There it is prepared by the in complete combustion of pine wood or oil. The soot so formed is mixed with fish glue size, scented with mark or camphor, it is moulded into sticks and then dried. These sticks are dissolved in water when a supply of ink is required

The gum arabicused in the manufacture of the western variants of" indian ink" emulsifies the oils in the soot (carbon) gives viscosity to the fluid, holds the carbon particles uniformly and acts as a binder to fasten the black particles to the fibres of paper, or the surface of vellum. After drying, the carbon is unaffected by light or other bleaching agents. Neither carbon nor gum arabic is injurious to paper.

In about the seventh century iron gall ink came into use for writing on vellum and parchment because the carbon inks did not adhere well to these materials. This ink was made by mixing copper as (ferrous sulphate) with oak galls and water and after staining off the extract, thickening with gum arabic. When the ingredients were combined in the paper amount the pale ink resulting flowed easily and penetrated deeply. After a few days it darkened to a black insoluble compound that was difficult to bleach.

Iron gall writing inks remain legible for centuries, but they often fade from dark to brown-causes of the fading are light, residual bleaches in the paper, or an excess of ferrous sulphate converts to oxides of iron (rusty browns), which in turn act on the black ferric tannate turning it brown.

Oxidation of the ink leads to the formation of acid. This together with hydrochloric or sulphuric acid added to the ink to improve its flow, has an adverse effect on paper. The acid in many cases perforated the paper. The modern practice is to add a suitable dye, usually of blue colour, so that ink writes blue, turning into blue-black, as the writing oxidises or matures.

A variety of dyes have been used for the purpose. The first to be used was extract of logwood which improves the colour of the iron gall ink and when heated with potassium chromate, produces a satisfactory deep- blue solution. Next to be used was indigo which increases the intensity of the ink. This was replaced by aniline dyes, which have become common constituents of iron-gall inks. Naphthalene blue is one of the most common dyes used in the ink industry.

A good ink should, as a general rule, 'yield permanent writing, which should turn into relatively black within a few days; flow rapidly from the pen and penetrate the fibres of the paper without passing right through them.

42.1 Modern Inks

Fountain-pen inks are extensively used for records where permanence is required, iron-gall inks cannot be used in good quality fountain pens as the acids they contain destroy the ribs. They have been supseded by solution of synthetic dyes which are free from acids. Among thedyes used are Black Nigrosine, Fuschine, Brilliant-Orange, Napthal yellow and Diamond Green, However such inks have poor light fastness and hence are not permanent. They are soluble in water of other solvents with thejssult that writing spreads on becoming wet. These defects have been overcome by the use of certain substantive dyes which on drying adhere to the fibre. These inks are fast to light.

Ball-point pens do not function properly with iron-gall inks, chifly because of their acidity arid muddiness. The inks used for such pens are with organic solvents and may be washed off without difficulty. They do not sink deeply into the paper and may thus be removed easily with soaking in spirit or by an eraser. Recently introducd inks are effective and permanent with eraser without easily detectable damage to the surface of the paper.

4.3 Boards

The term ‘Board’ has several meanings in book making. When used in connection with the material in a book, it means hand covers to which the decorative covering is glued and applies whether they are made of wood, cardboard or any other material until about 1500 AD, almost all boards were wood. At that time pasteboards came into use and within a short time wood was the exception. Pasteboards were of three kinds: (a) those made by pasting together sheets of low quality paper or printing spoilage, (b) a better grade made by matting together wet sheets of new paper as it was lifted from the vatman’s mould, and (c) an inexpensive pulped board made from paper shavings and often even floor sweepings. Each of these is easily recognizable when an old book is disassembled. They all wear fairly will until the leather covers wear offand they rapidly crumble at the corners.

Modern boards are usually made of paper and they are available in many wrights and sizes. There are three qualities: best black millboards, machine boards and straw boards. The tough, heavy black millboards are made from rope and stand heavy usage. Machine boards include a wide range of boards made from various fibres. Wood pulp, waste paper, waste chips and some fibrous by-products of other industries all go into machine boardsJThey are not as heavy as least black millboards, but some of them are fairly tough. They should be used with caution as valuable books because of uncertainty about their composition. Strawboards, as the name implies are made of straw and are the cheapest. They are soft, have little strength and warp easily. Strawboards should not be used on anything of value.

4.4 Adhesives

Adhesives commonly used are flour or starch paste and glue. Glue is the result of the hydrolysis of the protein collagen, the main constituent of the skin of animals. Glue can also be extracted from the connective glue and gelatine, both colloids and chemically alike, merge into one another by imperceptible degrees. The difference is one of purity-the less pure being glue valuable as an additive to paper. Ani'mal glue is sold commercially in awide variety of forms and colours. Hide glue, the best grade, is made from hide scraps and trimmings, the wastes from tanneries. Bone glue is an inferior product and should not be used for fine wprk. The glue making process, regardless of the source of protein, consists of washing the stock, crushing or shredding k, boiling to extract the gelatinous staff, gelling and finally drying on screens. The resulting hand, brittle sheets are then broken into flakes or ground into powder. Ground and flake glue is too stifffor some bookbinding uses. Flexible glue is made by adding glycerin, dicthylene glycol to flake glue. Diethylene glycol, because of its lower viscosity is the best for this purpose. Glue, as an organic material is susceptible to mould preservatives, such as beta napthal, are added to prevent mould and bacterial growth. Deoderants, such as terpineol are also a necessary ingredient in commercial glue.

Gelatin extracted from fish bladders is called isinglass,; wastes from fish processing plants are also made into liquid glue. It is inferior to animal glue and is more eassily spoiled by bacterial decomposition.

Casein glue, made from milk and line is one of the strongest adhesives known; It has been used for centuries in wood working but is not suitable for bookwork.

Gums and resins are complex mixtures obtained from various plants. The gums can be dissolved in water the resins must be dissolved in spirits. Gums and resins contain essential oils, natural colouring matter and various impurities. Paste, the most common substance for joining paper, is made from the flour of grain,

Animal glues have been largely replaced in bookbinding by PVA (Polyvinyl acetate) glues, made from synthetic polymers with additives. They dry rapidly and do not provide a food source for insects.

4.4.1 PVA Adhesives

Polyvinyl acetate is a synthetic resin in which vinyl acetate molecule- in numbers of perhaps hundreds or thousands-have joined to form large chain -like molecules linear or branched or both. The single vinyl acetate are called monomers. When numbers of thesejoin the result is a. polymer and the process is polymerization. Vinyl acetate results from the reaction of acetic acid with acetylene in the presence of mercuric oxide as a catalyst. The manomer is a liquid at room temperature; its viscosity increases with polymerization through low-metting solids to tough, horny materials.

The characteristics of PVA are noted below :

It is essentially odourless, tasteless, not-toxic and non-corrosive to metals.

It is clear, non-crystalline.

It is highly thermoplastic, but solid at room temperature. PVA in dispersed from in water is commonly but inexactly called an em jlsion. In this form it can be applied with brush or otherwise, Similarly to solutions of animal glue.

4.5 Cloth

Cloth is meant for book covering in library collections in 19th centuiy and 20th century bindings. It is usually woven cotton fabric impregnated with a filler to auifen it. Starch was initially used as the filter, but because of its susceptibility to water damage and to mould and mildew has now been replaced by plastics, usually pyroxylin but sometimes vinyl. Vinyl, however, can cause problems when the plasticizers in it are released onto adjacent materials Other materials suitable for use as book coverings, such as vinyl-impregnated paper, are being developed.

Canvas is a coarsely woven cotton cloth with no filler. It is durable, but soils readily and has little aesthetic appeal. Edition book cloth is closely woven, light wright, starch filled cotton, -sometimes lightly, embossed to conceal the weave of the fabric. It is often very attractive but having no strength or durability. Buckram is a heavier fabric with a clay and starch filler and is sturdy enough for hard-used circulation library bindings

Silk has been used on book covers primarily for luxury editions. It is very expensive because silk covered book generally requires boxes to protect them. The materials however, is frequently used in expensive bindings. Pure silk is one of the best fabrics for reinforcimg paper. This is thin, light, wrigbt, strong and flexible material, also called Japanese paste within its fibrous structure to make a strong band and when properly applied is almost invisible.

Book covers of velvet, often studded with jewels, were made for royalty as early as middle ages. Velvet is a textile made of silk and covered on one side with a close short, fine; soft stag, the other side is a very strong close tissue. Uncut velvet, is sometimes woven simultaneously with the cut tp create figures on the cloth.

4.6 Sewing Materials

The best thread for sewing books is linen, silk, cotton, nylon, dacron, rayon and other threads can be used, but none has proved to be as uniformly satisfactory’as linen from Belgium and Ireland. Silk is advantageous when a hand-sewn book has many signatures. The fine silk helps to minimise thickening of the spine cotton as synthetic fibres threads are quite satisfactory for use in book-sewing machines.

Linen thread is made from the straw of the flax plant. Synthetic threads are made by

extruding plastic material into chemical baths where it is coagulated into a continuous thread before being dried and taken up on pools. Like cotton threads, they are highly refined products of uniform quality, but without streagth and durability of linen

The gatherings of pages in better grade cased books and all handbound books are sewn to each other and these to tapes or cords. These tapes and cords serve the double purpose of holding the gathering together and of providing a means for fastening the boards to the books. Bookbinding tapes should be made of high quality cotton or linen. Synthetics should never be used because they repel paste and glue and make it difficult to fasten the boards to the book.

4.7 Miscellaneous Materials

Spine inforcing materials include crash and flannet. crash also known as super, is glued to the spines of some books to strengthen them and reinforce the hinges. On some machine-made books it is the only hinge. The open weave of the fabric permits the glue to strike through easily and the lining gets a good grip. When more strength is required Canton flannel, which is fleed on one side is used in place of super. Machine-made headbands are purely ornamental and do not strengthen the book as do handmade headbands of linen silk of cotton which are braided on strips of cords and labelled into the signature of hand-bound volumes.

Varnishes are sometimes applied to finished book covers to get glass and to provide some protection against insects and fungi. Varnish also keeps oil from hands away from leather book covers. This is not desirable because conclusively proven that the leather on frequently handled books, out-lasts identical leather on books which are rarely handled. Vanished book covers are also impervious to other leather preservatives.

To make paper suitable for writing and printing, it is suggested to make the matter fibres a hard surface, otherwise paper would absorb the ink like a blotter. This coatings of gypsum and pastes of lichen starch, rice or wheat to the finished sheets.

Rosin is a natural resin obtained from turpentine by distillation. There are several varieties varying in colour and transparency. It makes paper stiff, resistant to water and more suitable for receiving ink. All the same time rosin in paper has a catalytic effect in the action of light on cellulose fibres and it accelerates the deterioration of paper.

Alums used for sizing paper are aluminium sulphate. These substances seem to have the same effect on Cellulose as rosin. Commercial alum (potash) which is aluminium potassium sulphate is used in modern paper making to precipitate rosin size on cellulose fibres

4.8 Summary

In this unit we have discussed the physical elements of a book. There are different varities of inks and a variety of dyes have been used for these purposes. Different qualities of boards have been highlighted. There was very little change in the technology of adesives between the time of Egyption Civilisation and the introduction of synthetic adhesives into the century. Finally, different sewing materials have been discussed.

4.9 Exercise

1. What are the common constituents of iron-gall inks?
2. Note the advantages of silk thread in binding.
3. Describe the characteristic features of good ink.
4. What are the commonly used adhesives?
5. What are the different kinds of paste boards?

4.10 Keywards

1. Adhesive : A substance capable of holding materials together by a surface attachment. It includes such materials as glue, paste. Polyvinyl acetate emulsion is a very strong adhesive.

Case : It is the cover of a book, printed, stamped and made the proper size to be attached to a book.

Cord : A string composed of several strands twisted together.

Rosin : The additive most commonly used for the sizing of the paper,

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Unit 5 ❑ Non-Book Materials

STRUCTURE

5.0 Objectives

After reading this unit year will beable to:
1. understand the generic term ‘nonbook’ materials.
2. know the variety of non-book materials

3. know the data storage technology including CD, DVD
4. understand the methods of proper care and repairing of these nonbook materials.

5.1 Introduction

Most libraries contain a wide variety of objects. In fact, today's libraries are having steadily growing variety of materials, other than paper. They are known as a generelly accepted generic term 'non-book materials'. This generic term lnon-book' includes two broad categories: print and non-print. The non-print media are those on which printed words or visuals are not directly represented. Examples are magnetic tapes, digital recordings. Media which represent direct impressions or visuals are films, filmstrips, photographs and the like. The non-book materials which are mostly reading materials like monographs, pamphlets, off-prints, memeographed documents, etc. can be repaired like paper documents. Each of the non-reading non-book materials should be specially treated considering their physical nature and base materials.

5.2 Newspapers

A newspaper is a serial publication which is designed to a primary source of written information of current events, connected with public affairs, either local, national and/or international in scope. The evolution of the newspaper is closely linked with the development of print, which enabled people to communicate news and views far more widely than was possible in manuscript form.

Until the middle of the nineteenth century most newspapers were printed on durable rag paper, those that have survived the ravages of man can survive for generations to come. Newsprint is sensitive to heat,- humidity, air pollutants and light. Ironically, it was at the end of the nineteenth century that librarians and archivists began to recognise the research value of newspapers and began to collect and preserve them.

The primary task in organising the newspaper collection for preserving and access is rehousing the material and controlling the environment where the collection is kept. Microphotography was chosen as the solution to the problem of preservation and access. Later preservation microfilming initiatives were undertaken by major research libraries. Many newspapers are extremely brittle and cannot survive the microfiling process; the preservation of their contents through microfilm is better than nothing. Mass treatment technologies may eventually enable librarians to preserve many newspapers that have survived in their original form. Newspaper is made from wood fibres and it will turn dark and brittle very quickly when exposed to light.

The only way to preserve the original is to store them properly :

(a) Place clipping in a polyester film folder with a sheet of alkaline buffered paper behind it.

(b) Put the polyester folders in the file folders and boxes of high-quality acid-free, alkaline buffered materials.

(c) Store in a cool and dry location, such as closet in an air-conditioned room.

Microfilming has resolved some of the problems in connection with the care of filed, newspapers, but there will always be a requirement for the preservation of some originals even after they have been filmed. Newspapers should be stored in dark rooms, which are lighted by incandescent light, only when it is necessary to retrieve an issue for reference. Newsprint should be protected by filtered alternatives and warranted. Binding these akward sheets is unquestionably good protection, against wear and tear, but newsprint between the covers almost as rapidly as in the open air.

The United States is'the only nation to recognise the need to preserve its newspapers. In 1980 the International Federation of library Associations and Institutions (IFLA) Section on Serial Publications established a Working Group on Newspapers to consider all matters relating of newspapers in libraries. It has been surveying preservation policies of newspapers collections world wide. IFLA's Working Group on Newspapers is actively promoting and supporting initiatives for the preservation of the World's newspaper for future generations.

5.3 Maps

Maintaining a map collection can be costly and time-consuming, but maps are primary source materials that are an integral part of library collection. Most maps can be stored, as prints, in acid-free boxes or in cabinets, but their variation in size tends to prevent the easy adaptation or a system for storage and access. Maps vary in size and are made on paper or cloth. Most maps are large in size and these have to endure more strain in use than ordinary map. They do not have also strong support. Both cloth and paper are vulnerable to mould growth and insect attack. Adhesive and loading materials used in maps are proved to be damaged. Usually repairing method of map is mounting. It is a process of reinforcing and strengthening,

Maps are frequently found in deteriorated condition due to poor storage condition and heavy use. Mounting on cloth, malual or long cloth is a good repairing method for longer life and gaining strength to withstand ware and tear. Paper mounting is not durable. The mounting cloth is moistured in water and stretched on the glass-top table and fixed to it. The map or chart, usually one side blank, to be mounted is cleaned and flattened. It is placed face down on a wax of glassine paper and paste is applied to its back. It is then transformed from the glassine paper to the stretched cloth and uniformly pressed. The pieces of cloth used for mounting should be slightly larger than the size of the map or chart to be repaired. When the mounting is done and the map is dry, the margins can be trimmed on two sides and the top side and bottom side are pasted with wooden rods. Maps and charts are to be kept flat and stretched. Folding can cause damage to maps. In repairing each

map should be taken as particular case, so mounting should be done after proper examination of the damage and either factor.

Once a valuable map has been cleaned and repaired, it can ajso be hinged into a 100 percent rag board mat to retard its cjpterioration and to factlitiate its use. Polyester incapsulation, which is an inexpensive and reversible process, is often the most practical way to prepare fragile maps for use, Rare maps, to be kept in a permanent collection, should not be laminated Lamination techniques can be very damaging.

If the surface of the face of the map is found to be cracked or broken, chiffon can be used for protection. A piece of chiffon has to be cut to required size and then placed over the affected portion of the map. It is pasted with the.help of a brush from centre to edges. Then the map is covered with waxed paper and rubbed from the top to ensure proper repairing. It is to be dried under light pressure. Charts can be repaired in the same method.

Atlases are usually kept with map collection. Atlases which are oversized should be stored flat. These are frequently consulted and as such can deteriorate over a relatively.short period of time. There have been practices of disassembling the heavily consulted atlases, repairing the pages, encapsulating them, and placing them in post bindings. This method of housing is expensive and requires considerably more space for storage, but it is be for the best way to provide access yet protect valuable and heavily used atlases.

Globes and relief models, often found in map collections, are specially difficult to protect. These are particularly susceptible to dust, environmental changes, and careless handling. They should be covered when not in use or, if on display, when the collections closed.

5.4 Paintings

Paintings include pictures of local sights, or personges, or works by local artists. They are often found in library collections. They are artefacts that represent cultural heritage and deserve care and conservations. They should be preserved and displayed properly. Paintings may be done on any surface, but most are on wood panels or on canvas. Both of these materials respond to changes in their environment and they require environmental control to prevent irreparable damage from fluctuations in temperature and humidity, dirt, air pollution, excessive light,, fungi and moulds, insects and vermin. Paintings should also be protected from people who handled them carelessly.

Paintings require periodical examination to detect signs of damage and age. If deterioration is obvious a reputable conservator of paintings should be consulted.

5.5 Photographic Materials

The term ‘photography’ means literally “to write with light”. The modern photographic image has two forms : the negative and the positive photographic print. The positive print is the image made from the negative, the final part of the negative-positive picture-making process. The photographs is thus a chemically fixed image, folding a lens-produced pattern of light. Photographs can be considered works of art on pap£r. Because of their additional chemical components, they are even more fragile and subject to physical and environmental hazards than other paper-based materials. Because of their complex, chemical composition, the physical nature of photographic images is more complicated than that of paper and ink.

The common problems that the librarian of a photographic collection will encounter are chemical deterioration and contamination, tears, abrasions, scuffs, fingerprints, dirt, marks with pressured objects such as paper chips, stamps, etc, broken glass plates: cracked emulsions, scratched and soiled negatives; and photographs on highly acidic, brittle paper or board.

The enemies of photographs are high temperature and relative humidity, rapid fluctuations of both, air pollution, light, and improper handling. Photographs are hygroscopic and thus are specially susceptible, to atmospheric changes. Light causes photograph to deteriorate. Photographs also attract insects and micro organisms that will attack the ingredient in the image, as well as the paper.

5.6 Slide

Slides are a heavily used part of a library collection. Slides are another form of photographic image. Slide indicates a photographic format. Slide collection need special handling and requires due care. Slides, specially colour slides, are susceptible to the hazards of heat, light and moisture. The greatest harm to the slide occurs at the moment of projection, when the image is suddenly exposed to intense heat and light.

The best kind of container for storing slides is one made of either metal with leaked enamel finish or high impact plastic.

5.7 Image

Motion picture films are among the most popular materials in circulating library’s collection. Motion picture films is one of the most fragile materials to be found in libraries? If motion picture film is housed in a good environment and used carefully, it should have a relatively long life in a circulating collection. Films should be stored flat. Motion picture films should be wound on a case of inert material and kept in sturdy metal or plastic container that assures proper support and protection.

5.8 Microforms

Microforms are generally grouped into two categories: Micro-transparencies ano Micro-opaques, which can further be divided into various types. Under Micro-trasnparencie&we have Roll Microfilm, Unitised Microfilm, Microfiche, and Ultrafiche, in Roll Microfilm images are arranged in a linear way. Rolls are often split into small lengths, each of which becomes a unit, referred to as unitised microfilm. Microfiche comprises a number of rows of reduced images of documents produced on a transparent sheet of film. Subject to the ratio of reduction, the microfiche varies in number of frames. In libraries ninety-eight frame microfiches are generally used. Ultrafiches have high number of frames. In ultrafiche the original is reduced to overtimes.

Micro-opaques can be divided into Micro-card, Microprint and Microlex. Micro-card is produced by photographic images. It is an opaque card with size of 3″ × 5″ size containing a number of reduced images. Microprint is larger then micro-card having a size of 6″ × 9″. Images of Microlex cards are produced by photographic methods. Its cards cantain 200 pages one side. The size of cards are approximatly 6.5″ × 8.5″.

Microforms need careful i.andling and sophisticated storage condition. Microfilm reels are stored in specially designed metal cans, which may be sealed, if desired with a good quality rubber base pressure sensitive tape.

One method of preservation is to store microforms under proper environmental conditions. The storage area should be free from dust particles and other contaminants. Before using the microforms, the microform reader, reader-printer should be inspected and defective instrument should not be used.

5.9 Sound Recordings

Sound recordings are subject to deterioration both in storage and during playback. Sound recordings are sensitive to ultra-violet rays and deteriorate on exposure to sunlight and artificial light rich shorter wave length. Heat causes both physical and chemical changes. Moisture is both a physical and a chemical agent to degradation, Dust and grit bring both physical and chemical degradation in sound recordings. Oxygen may cause minor or major chemical degradation Fungi cause significant deterioration of the organic ingredients used in sound recordings

Collections of sound recordings are a heavily used part of a library collection. As is true of all library materials, a clear, well-ventilated environment will extend considerably the life of sound recordings and play-back equipment.

5.10 Compact Disks

By the mid-1980s compact discs with digitally encoded sound entered the commercial market; increasingly they are purchased and circulated by librsriss. Compact disks, played back by a iaser, were supposed to be impervious to the hazards that threatened eailier disks. While compact disks do offer considerble protection from risks of rough handling and playback, they have had their problems. Digital recording is a complex matter. The loss of even a few bytes of sound can be dramatic. A disease, called ‘laser rot’, was first observed by videodisc owners as early as 1993, when images on the disks became ‘snowy’, due to loss of digital data.

5.11 Optical Disks

Depending on the equipment. ?.nd technology used, they can store text, images as’well as sound to work as a multimedia information system. At present there are three kinds of optical disks: (1) Write Once Read Many (WORM), (2) Rewritable, and (B) Read Only Memory (CD-ROM).

The CD-ROM has invaded the library, often replacing paper-based imformation tools. CD-ROM should be kept and used in an environmentally controlled area.

Air pollutants and contaminants can seriously harm optical disks and cause loss of data. Under no cricumstances should smoking be permitted in areas where optical disks equipment is housed. Optical disks should be kept in their plastic cartridges. Shelving should be done in a vertical, upright position.

5.12 Magneto-Optical Disks

Magneto-optical disks may play a role in systems of audio preservation and distribution. They are less expensive than hard disk drives and can provide between 20 and 40 years of viable storage. In the future, blue laser magneto-optical disks will quadruple the amounts of storage capacity. Preservation and restoration-Method for estimating life expectancy of magneto-ppticaI(M-0) disks, which is based on effects of temperature and humidity. To develop this standard, a sampling of 80 disks was base line tested for byte error rate. The standard gives a graph that can be used to estimate the time for a given percentage of disks to fail.

5.13 Conclusion

The development of successful preservation strategies will require the cooperation of computer scientist, data storage experts, data distribution experts, field workers and librarians. The preservation of historical material in digital form is just as dependent on developing appropriate metadata as it is on bit integrity, which means involving subject experts as well as technicians.

5.14 Summary

In this unit we have discussed various non-conventional documents, which are known as non-book materials. We have highlighted microforms, compact disks, optical disks and magneto-optical preserving all non-book material. The CD-ROM has replaced paper-based information tools. Modern libraries collect all non-conventional documents, and librarians should be alert for their stability, care and handling, They should be kept under proper storage condition. Equipments to be used for reading non-conventional doccuments have been pointed out.

5.15 Exercise

1. How would you preserve newspapers in a library?
2. How are rare maps kept in a permanent collection?
3. What are the problems that the librarian encounters in respect of photographic materials?
4. Discuss microforms along with their varieties. 5 Describe the different kinds of optical disks.

5.16 Keywords

Compact Disk (CD): A fast rotating variable speed aluminized disk with very fine spiral pattern of extremely small “pits”’ in its surface that are detected by a laser beam to reproduce sound.

Digital recording : a sound .recording made by a process whereby the source sound and/ or image is transformed into continuously variable voltages. Reproduting involves tracing or “reading” the stored pattern and converting it to a recorded format for playback.

Disk(Diskette) : A magnetic-coated storage device that is flat and round and stores information by having its magnetic charges changed.

Encapsulation : Enclosure of a document between two sheets of polyester film sealed with pressure sensitive tape, by ultrasonic welding or sewing. Two layers support the sheet and allow it to be handled and seen booth sides. Encapsulation is reversible.

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Unit 6 ❑ Digital Objects

STRUCTURE

6.0 Objectives

After reading **this** unit you will be **able to :**

1. know the nature of digital information
2. know what makes it different from the world of paper

6.1 Introduction

The preservation of digital objects (defined here as objects in digital form that require a computer to support their existence and display) is obviously an important practical issue for the library and information profession, with its importance growing daily as more information objects are produced in, or converted to digital form.

6.2 Nature of Digital Information

Modern information systems are based on digital principles : ones and zeros represent the presence or absence of a physical reality (like electrical current). Any type of information we require to store and manipulate with a computer-numbers, text, images, sounds and instructions-must be converted from uialog to digital form. “Analog” means that something varies continuously, like a watch with a sweep second hand. In an analog world, we can say, “It is approximately a quarter after seven,” which means, “It is analogous to quarter after seven.” It is common to express an analog reality as a wave, a flowing continuum of choices.

In contrast, a digital world is one in which there are discrete states with no other choices. A digital watch shows either 7 : 15 or 7 ; 16, but cannot be somewhere in the middle. Instead of a wave, which varies continously, a digital representation is restricted to specific,, predefined choices. If we translate into computer terms, digital means that something is either 1 or 0, yes or no, on or off.

6.3 Digital Representation

These basic principles are at the heart of our representation of the following :

Numbers
Text
Images
Sounds
Instructions

6.4 Representing Numbers

From our childhood days, we are taught to commit a particular system of representation-the decimal system. As the Latin root of the word implies, the decimal system uses 10 different symbols to represent reality (the numbers 0 through 9). That is why we call the decimal system base 10. What happens when we have a number greater that 9 ? The

decimal system adds placeholders to the left, with each place increasing in value. In addition, the place values of each position are powers often.

Moving from right to-left, the first four of these places are

Thousand $= 10 \times 10 \times 10 = 10^3$	Hundred $= 10 \times 10 = 10^2$	Ten $= 10 = 10^1$	One $= 10^\circ$ anything raised to the zero power always equals 1

We use the combination often distinct symbols and place holders of increasing value to represent a number as follows :

Place value	Thousand	Hundred	Ten	One
Discrete Sumbol (0-9)	3	8	0	2
Calculation	3 × 1,000	8 × 100	0 × 10	2 × 1
Total	3,000	800	0	2

Therefore, the above number is 3,802.

We have other bases also.

Let us take base 12, for example. If you order a dozen bangels or measure the number of inches in a foot, you are using a system based on 12, but without 12 distinct characters.

Representing numbers for a computer follows the same basic principles as the base 10 example above. In this case, however, we are translating the number into a binary code, base 2, in mathematics. Base two uses only two symbols, 0 and 1. Also, the place values of each position are powers of two.

Each base-2 placeholder represents one binary digit, or bit, Eight of these bits equal a byte. The value of each of these bits is as follows :

128 $= 2$	64 $= 2^6$	32 $= 2^5$	16 $= 2^4$	8 $= 2^3$	4 $= 2^2$	2 $= 2^1$	1 $= 2^0$

The way we would calculate a number is as follows ;

Place value	128	64	32	16	8	4	2	1
Discrete symbol (0-1)	1	0	0	1	1	0	1	I
Calculation on	1×128	0×64	0×32	1×16	1×8	0×4	1×2	1×1
Total	128	0	0	16	8	0	2	1

To summarise, the number “10011011” in base 2 equals to 161 in base 10. If these are not confusing enough, the number 10011011 can also represent text, images, sound or instruction, depending upon how the computer is programmed to interpret it.

6.5 Representing Text

In order to represent text, we need two things :

A defined universe, or set, of characters to represent. The set of characters must include not only letters and numbers, but punctuation marks and “control” characters, such as end of paragraph mark.

An agreed-upon symbol to represnt each character in the set.

These requirements lead to the development of standards, since everyone must use the same characters and symbols if we are to communicate information. There must be a uniform code from one computer to the next.

6.6 Representing Images

The basic principle in representing images is to divide the page into a fine grid of picture elements, called pixels In the case of black and white images, each pixel will be captured as either black or white, with nothing in between (Please note that the digital means discrete states rather than varying waves) With more complex images-those involving shades of gray or colour-each pixel will have to represent more than just black of white. The pixel will have a value that translates into “degree of grayness” (for grayscale images) or colour (for colour images).

6.7 Representing Sound

Sounds are analog realities that are communicated on waves. When we speak, our vocal cords cause the air-to vibrate at a certain frequency. The sound moves through the air on a wave until it reaches the ear of our listener where (he wave is converted into meaning. If we are listening to music on a stereo, the voltage in the speaker wire causes the speaker to vibrate and launch its sound into the air.

These analog sounds must be encoded into digital form-to be manipulated by a compute? This is done through a process, called sampling, the level of the sound on the wave is measured and assigned *a* numeric value. This numeric value, in turn, is converted to digital form for the computer. On the other hand, the digital number is decoded and converted back into an analog form, comprehensible to our ears

6.8 Representing Instructions

The instructions, called programs, are the heart of computing. As with all other types of information, the computer's instructions must be started within the computer's memory before they can be used. Furthermore, they must be stored in binary form. A program is nothing more than a set of binary instructions, which the computer can follow, or execute. There are various "languages" in the process of creating instructions, moving from low-level (the binary code the computer understands) to higher level (structure and syntax similar to what humans use).

Computer programs have some specific preservation concerns : If the data we are trying to preserve will only run using a specific program, we need to preserve either the actual program or functionality of the program :

The best way to know how a program is constructed and what is intended to do is to preserve its "documentation" a code book or other reference materials created by its author

6.9 Physical Media

The physical media of the digital world fall into two main categories, magnetic and optical.

1. Magnetic media use the principles of electromagnetism to record and change electrical signals.

2. Optical media use concentrated light in the form of lasers to alter reflectance on the surface of a disk.

The key is that both media preserve information into two discrete states, corresponding to the ones and zeroes, of computer representation. Keeping your ones and your zeroes straight over time is the preservation objective.

6.10 Magnetic Media

Magnetic media rely upon temporary magnetism to record and erase the information we wish to store. While the information is active, the computer retrieves information from storage, brings it into the central processing unit, performed the desired operation and usually returns it to storage

All magnetic media are composed of three principle layers :

Recording material, substrate, and Binder.

The recording material must be capable of being magnetised when placed in a magnetic field. The recording matenal also needs to retain the magnetism when the field is removed. This retaining of information is what ?Rstinguisbes storage form memory. The latter, often referred to a Random Access Memory (RAM), is a volatile, temporary holding area that is erased when the computer is turned off.

The substrate is the base material upon which the recording material is coated. It is a carrier for the information. Examples of substrate are ? nickel-reinforced aluminum platter, a thin ribbon of polyester film, ceramic materials, and giass compounds.

The binder, as the name implies, fastens the recording material to the substrate. It is an essential but often overlooked layer of the magnetic club sandwich.

Magnetic media fall into two categories : disk and tape—Magnetic Hard Drives and Magnetic Tapes.

6.11 Optical Media

Optical media use light generated by lasers to record and retrieve information. They record information by altering the light reflectance characteristics of a given medium : reflecting light a certain way equals a “one” while reflecting light a different way equals a “zero”. One category of optical disk is called WORM ; Write—Once, Read Many,

“Compact disc” uses optical storage formats and based on technology developed jointly by Sony and Philips during the 1970s and 1980s. Compact discs have a reflective metal layer covered with a protective coating. Information is recorded as microscopic pits and adjoining spaces arranged in spiraling tracks.

CD-ROM stands for compact Disc-Read Only Memory. CD-ROM is the application of compact disc technology to the storage of computer-processible information. CD ROMS measure 4.75 inches in diameter. The principal advantages of CD-ROMs are their relatively low cost, widespread availability, and established international standards.

Another option, Compact Disc-Recordable (CD-R), became available in the late 1980s. CD-Rs permit direct recording of information on compact Disc without going through the mastering process that previously was necessary, CD-Rs can store over 600 megabytes of data but offer slower access times than other types of optical disks.

6.12 Summary

In this unit we have discussed the nature of digital information, The two major aspects of digital objects-digital representaion and physical media are explained. In the digital worlo* there are discrete-states with no other choices. The physical world of the digital world fall into two categories ; magnetic and optical. Magnetic media fall into two categories : disk and tape Optical media use light generated by lasers to record and retrieve information. Not only must we take our familiar world and convert it into the ones and zeroes of the digital domain, but we then must store the resulting representation on something quite different from our familiar paper.

6.13 Exercise

1. What we need to represent text in the digital world ?
2. What is the basic principle in representing images ?
3. Explain two main categories of physical media.

6.14 Key words

1. **BIT :** A bit is an electrical charge that is either on represented by 1 or off represented by 0. It is the smallest division of memory.

Digital: It consists of numbers and numeric represent~;;onsl typically binary numbers. Almost all computers use digital technique for storing and manipulating data.

Disk (Diskette) : A magnetic-coated storage device that is flat and round and stores information by having its magnetic charges changed.

Laser : Light Amplification by Stimulated Emission of Radiation. A device that transmits an extremely narrow beam of electromagnetic energy.

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Unit 7 ❑ Physical Agents

STRUCTURE

7.0 Objectives

As noted earlier, the basic and constituent of library mateirals are mostly organic. As such these are susceptible to natural decay and deterioration. In this unit we shall discuss the physical deterioration of library materials.

After reading this unit you will be abte to:

1 understand the hazards to library materials

2. know the causes of physical deterioration of library materials

3. identify the different factors responsible for the physical deterioration of the documents.

7.1 Introduction

Men are unquestionably the greatest enemies of the materials on \\hich they record their thoughts. To the long list of great libraries vandalized by conquering armies or burned in hate, must be added the incalculable loss and damage caused by petty theft, malicious

mischief and careless handling by individuals. This is all ihe more distressing because it is-almost impossible to control, short of imposing security measure, that would deny access to books to all but a select few The continuing loss due to misinformation, lack of information, or failure to use available methods of library conservation by the custodian of books is equally serious. Improper and faulty actions taken by the library staff may cause deterioration to library materials. Cheap and improper materials are often used for mending and repairing. Repairing, restoration and lamination work are done by untrained personnel. All these conditions cause deterioration or worse, aggravate deterioration of library materials. Almost all library materials deteriorate. Most are organic in nature. They deteriorate because the molecules from which they are built up break down into simples molecules.This process is entirely natural, can be slowed down, but cannot be stopped. The rate at which materials deteriorate is conditioned by two factors : 1. the inherent chemical stability of the material; 2. the external actions which affect the materials.

7.2 Agents causing physical deterioration

Physical deterioration is a slow but gradual process. It can be accelerated under adverse physical condition. The deteriorating factors are temperature and relative humidity, aging, heat, light and other physical conditions which are responsible for photochemical, hydrplytic or oxidative changes in paper. The visible signs of deterioration are disclouring and embrittlement of paper. The paper is weakened and binding of books loosen. Bad handling and frequent use of books also cause physical deterioration.

7.3 Temperature and Relative Humidety

Relative humidity is defined in terms of temperature, as the amount of water vapour in a volume of air expressed as a percentage of the maximum amount that the air could hold at the .same temperature. The warmer the air, the more moisture it is capable of holding; therefore, if the temperature rises no extra moisture is added to it, the relative humidity will decrease.

Both the moisture content of the air and the temperature in library storage facilities arc important. If they are too high, they speed up the. rate at which chemical reaction takes place and the rate of deterioration is there by increased. One example is the deteriorative action of acid hydrolysis on paper. This process is both water-and temperautre-depenJend. If both temperature and the relative humidity are to high, mould is more likely to grow il should be noted that moisture itself cause physical deterioration of the library- materials Moisture makes the paper soggy, and thus weakens the tissue of paper.

Rapid changes in temperature are particularly damaging they cause expansion of materials if there is an increase of temperature or contraction, if the temperature decreases. When temperatures oscillate rapidly, the stresses on the materials can cause significant physical damage. If the water content in a room is fixed, a sudden lowering of temperature will cause a rapid rise in the relative humidity and water may condense on the surfaces of object? whose temperatures have drpopped. In this way water damage such as staining can take place. One of the significant factors to control in order to reduce deterioration, is therefore, the,speed at which temperatures change.

Library materials swell or sink as relative humidity changes as organic materials are hygroscopic (that is, they expand and contract as moisture rise and fail).

It is worth to note that changes in relative humidity are concomitant with the changes in temperature. A bound book, made of many materials, all of which expand and contract at different times at different rates, will be particularly affected by changes in relative humidity, because conflicting pressures are exerted at different levels. It is important to control the rate of change in relative humidity to minimise deterioration of library materials.

Very high humidity levels are also harmful in other ways. They may cause water soluble inks to run and paptr which is coated with china clay or chalk or slilk. Very low humidity levels turn many materials brittle, so that paper breaks when handled, and book covering materials may shrink, warping boards in the process.

The two most important requirements for library materials are that the temperature should be kept as low as possible and that it is essential to slow down the rate at which - temperature and relative humidity change. There will always be need to compromise between the comfort of humans working in and visiting a library and the storage requirements of the collections. People will feel comfortable with a balance of temperature and relative humidity within a limited range of variation, while library materials also need a balance—but this will differ from human requirements and further more, -will vary from one kind of material to another. A working compromise should be struck.

7.4 Aging

Paper is made of vegetable fibre so it is subject to the process of aging. Paper as a product has mechanical resistance but it decreases with aging by the passage of time. The rate of aging usually depends on the quality of raw materials from which the paper is made as well as on the condition of storage arrangement and environmental condition. Low grade paper, containing large amount of wood, pulpages quickly because of the lignin content which results in rapid disintegration Lignin readily reacts with oxygen in the atmosphere and the acids present in the atmosphere^The chemical degeneration of lignin is acclerated by humidity and moisture.

Cellulose pulp is also subject to aging due to oxidising action of atmospheric oxygen,

which is itensified in presence of alkali. Cellulose hydrolysis is caused by acid in atmosphere mixed with humidity. The acidity of paper has a considerable influence on the aging of paper and thus on materials. The aging process in paper involves a degradation of cellulose fibre when the celulose macromolecules are degenerated, the mechanical strength of paper weakens. Both the physical and chemical factors and atmospheric condition acclerate the process of aging. All types of paper, irrespective of ingredients of which they are made, must deteriorate with age. Even the very good quality paper changes its condition with the passage of time which make the paper yellowish and cause subsequent embrittiement. Such deterioration is inevitable.

7.5 Heat

The natural deterioration of aging is accelerated by heat and increase of temperature in storage area. If the books or other paper materials are exposed to high temperature for a short period, the paper becomes yellow/and brittle. It causes dehydration and paper loses its usual stregth. It will be difficult to handle such documents. High power electric lamps may increase the room temperature. Damp heat makes the paper soggy and creates conditions for the growth of moulds.

Room temperature of 20°c-25°c and relative humidity of ± 55% provide the ideal condition for the preservation of paper documents. Heat accelerates photolysis, hydrolysis and oxidation. Heat causes buckling of edge on the film and tape, embrittiement and curling of film and tepe.

7.6 Light

Light is a form of radiant energy and as such is a source of energy needed for chemical reactions such as breakdown of complex cellulose molecules to simple molecules in paper. Damage accrues in library collections when they are exposed to direct sunlight fluorescent light and ultraviolet light. All objects which are exposed to direct sunlight are threatened. Light may be natural and artificial. In the natural light several kinds of rays are present. These are visible ray of light, cosmic ray, gamma ray, x-ray, ultraviolet rays, near ultraviolet rays and infra-red rays. All these rays are harmful to paper. The ultra-violet rays coming direct from the sun cause damage to cellulose bond creating photolysis. They also bleach coloured paper, leather and textiles. Paper of low quality becomes yellowish because the non-cellulose materials such as lignin break down into acid compound. The modern inks, dyes, clour and pigments become fade, decoloured or dark by ultra-violet ray.

The artificial light also contains ultra-violet rays. The fluorescent tube light radiates

high percentage of ultra-violet rays but the light is rather cool. The incandescent lamps *raww.e* minimum ultra-violet rays but gives -much heat. Heat and light cause deterioration simultaneously. Both natural and artifical lights are destructive to library materials. The ultraviolet radiation cause loss of strength and oxidation of cellulose. The kind of paper and cellulose content present determine the extent of deterioration by light, but the presence of rosin, glue, lignin, iron, alum and other sizing and loading substances have a strong hearing on deterioration by light.

Preventing the deleterious effect of light on library collections is in principle straight forward : keep light levels as low as possible, and preferably keep collections in the dark.

7.7 Darkness

Direct sunlight and excessive light are harmful to libray materials, but light is required in storage area. Light because of its heat clement, absorbs moisture to some extent. It also hinders the growth of fungi and keep worms~and-msects out from thin hiding corners. Darkness creates a condition for breeding of biological enemies and make their hide-outs. These enemies cause much damage to library materials protected undsr cover of darkness. Humidity and moisture are increased in dark area causing physical, chemical and biological deterioration. Light levels, like temperature levels, need to be kept as low as possible in all library areas.

When a library is closed it should be kept in darkeness. Regardless of the fact that darkness encourages mould growth and attracts vermen, all document rooms, store rooms, and closed stacks should be darkened except when in actual use, and illumination in these places should be by incandescent bulbs or filtered fluorescent lights.

7.8 Moisture

As do heat and ! rght, moisture works both for and against the preservation of library materials' A certain amount of moisture is necessary for flexiblitity During summer and monsoon, moisture is caused by high humidity. Excessive moisture in paper encourages mould grouth and makes paper brittle. Bark books and manuscripts that have been wet crumble when dried.

Too much moisture in leather encourages mould grouth, which first changes the colours of dyed skins, then attacks the leather itself Too low humidity dessicates leather. Prolonged exposure to Sow humidity will ultimately convert leather into a bituminous-like material

Mould spores are in the air every where, but they can only establish themselves on a surface when moisture is present. The naturally high humidity in tropical and semi-tropica! regions is of the gravest concern to librarians. Fungi can be destroyed by high temperatures and fungicides, but the most effective treatment is to control the moisture so necessary for

the growth of these micro-organisms.

Moisture in the form of water from baking roofs, defective plumbing, and clogged drains all too frequently finds its way to shelved books, print and map cases and manuscript files, where it cockles vellum, stains paper, obliterates writing ink, ruins cloth book covers, rots leather and wood, and rusts metal. The water runs between wall, under bookcases and filing cabinets and into basements, to the great joy of the insects and vermin inhabitating those places.

Moisture causes softening of gelatin on film and sound tape. Rolled films, tapes and microfiches can stick together while they are in contact under condition of moisture. Dust in contact with mi .isture causes physical and chemical degradation. It also causes biological deterioration ynder moisture.

7,9 Summary

This unit throws some light on some of the hazards which cause physical deterioration of library materials. The deteriorating factors are temperature and relative humidity, aging, heat, light, darkness and moisture. These factors that aggravate deterioration of library materials have been discussed in detail.

7.10 Exercise

1. Describe the major agents cansing physical deterioration of library materials
2. How are high humidity levels harmful to library materials ?
3. How does direct sunlight threaten the life of paper of a book ?
4. Discuss the impact of moisture on library materials.

7.11 Keywords

Cellulose A carbohydrate forming the chief components of cell walls of plants and of wood (cotton down, linen fibre, wood pulp being almost pure cellulose.)

Fungus A plant of one of the lowest groups, thallophytes without chlorophyll, including mushrooms, toadstools, mould, etc.

Humidity A moderate degree of wetness.

Relative Humidity Absolute humidity is the amount of water vapour in any unit of volume of air. Relative humidity usually meant when the term humidity alone is used, is the percent of moisture relative to the maximum level that air at any given temperature can retain without precipitation.

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Unit 8 ❑ Chemical Agents

STRUCTURE

8.0 Objectives

Chemical deterioration is the most damaging and destructive condition for library materials. After reading this unit you will be able to :

1. know that chemical deterioration is caused both by internal and external factors
2. understand that chemical deterioration is detected while the damage is caused effectively
3. understand the atmospheric pollution responsible for damaging the documents as physical entities.

8.1 Introduction

The causes of decay and deterioration of the library materials are the atmospheric pollution, the effect of acid, action of inks, effect of printing, and other chemical impurities on paper and other materials. There are other various causes like dust and dirt, and storage condition of materials. Thus these causes are complex and complicated. Such varying causes are aggravated by the environmental factors.

In the manufacturing of paper, often fibres are used with low cellulose content or non-cellulose content by which paper degenerates quickly. Mineral and chemical compounds used for sizing of .paper decrease the durability of paper. The presence of metallic traces accelerates oxidation and oxidizing agents present in the constituents of paper make the paper weak. Alkalies used in the manufaclruring of paper affect the paper and fungi grow rapidly on such paper.

8.2 Agents Causing Chemical deterioration

Chemical deterioration is caused both by internal and external factors. The internal factors are inherited by intrinsic conditions, existing within the elements of the physical composition of library, materials. Deterioration caused by internal factors will be revealed only when the damage is done, and as such, no preventive measures are possible. These factors occur during the procss of manufacture depending on the new mateials used and methods of making finished products External factors for causing chemical deterioration take place so slowly depending on various internal and external conditions, that the deterioration is detected while the damage is caused to library materials more or less.

Chemical deterioration is more dangerous and the situation is more acute in our country as it is atropical country and heading towards industrialisation. The climatic condition, atmospheric heat and relative humidity, the moisture in rainy season, harmful atmospheric gases, industrial and environmental pollutants, dust and dirt, and iuch other factors are accelerating and aggravating the chemical deterioration both internally and externally.

Chemical deterioration is caused to paper, film, audio tape and other materials of chemical “composition by the chemical agents and through chemical reaction by acid, oxidation, gases, atmospheric contaminations, dust and the like. The chemical agents may settle on paper, film, tape, etc, from outside and can do harm by acid reaction. The Chemical agents added to the paper pulp, film, tape, photographic materials can do harm within the materials under external factors. The bleaching ingredients such as, sodium sulphate, bleaching powder, chlorine gas, etc, the sizing ingredients such as alum, starch, rosin, glue, gum, etc. The loading ingredients such as clay, chalk, talcum, gypsum, kaolin, calcium carbonate, titanium dioxide, zinc compound, etc. are added to the paper for the manufacture of different types of paper These ingredients cause both internal and external chemical deterioration. The major causes are given below.

8.3 Acid

Acid and acidic reaction are the major deteriorating factors for widespread damage to library materials of different types. The acid reactions may occur in various means and for various reasons. No library can take foil proof measures against these, factors. Acidification of paper and other materials may cross the danger point without much obvious manifestation of what has happened. In many cases acidification begins during the manufacturing process and deterioration occurs before the paper is used as library material.

The most common acid deterioration is caused by sulphur dioxide present in small amount in the atmosphere. The amount of sulphur dioxide is larger in industrial environments- It is gas element of burning sulphur which comes mainly from the combustion of coal and oil gas. Sulphur dioxide by itself is not so much harmful to library materials but when it contains small amount of iron or copper, particularly in case of modern paper, it may change to highly destructive sulphuric acid under adverse environmental conditon. The sulphuric acid, when it reaches to about one percent, accumulated in paper rapidly destroys the cellulose of paper. The traces of iron and copper present in paper or leather binding act as a catalytic agent to change sulpher dioxide gas into sulphuric acid. It causes degradation of cellulose fibres of paper by breaking down the molecular structure.

The acidity of paper comes from the sizing elements of alum androsin, lignin in wood pulp, residues of bleaching chemicals, iron gall ink and from other agents. Acid or acid reactions make the paper brittle and crumble and the paper loses the readability. The minute trace of acid can destroy the entire, document in course of time. Sulphuric acid is the most injurious because it does not evaporate. This condition makes the leather and other binding materials brittle, pauses *book* joints to loosen and thus binding tears off.

Another source of acid is the alum used to precipitate size: Since rosin sizing reduces the cost of paper production, it is used widely to adhere to the pulp fibres. The solution of rosin and alum is added to the pulp for binding the cellulose fibres and to make the paper sheet stronger one, but the rosin-alum combination, if not proportionately applied, increases the acidity in paper. The acid action of alum and its oxidation of rosin causes embrittlement and darkening of paper at an “elarly stage.

Another acidic source is ozone. Ozone with nitrogen dioxide, which itself generates rnore ozone, under the action of sunlight, damages organic materials by breaking the bonds between carbon atoms. Cellulose under moisturised condition is vulnerable to ozone and degenerates rapidly and loses its strength, £)zone is also responsible for fading the colour of book and Ulustrations.Binding materials like leather, gelatine, paste etc. are susceptible to the action of ozone in moisturised condition.

The major constituents of printing paper are wood pulp, either mechanical wood or chemical wood. Lignin is highly complex organic acid present around the cellulose fibres

of wood. It is not removed completely from the wood pulp manufacturing process of paper Lignin is subject to oxidation and is affected by light. It attacks the cellulose fibres of the paper and causes staining andembrittlement.

Ink is also a source of acidity because of chemicals used in the composition. In iron gall ink sulphuric acid is formed by reaction of ferrous sulphate with gallic and ‘tannic acid. The quantity of acid formation depends on the concentration of chemicals used. The higly acidic ink damages the paper and spreads over around the printing. And thus paper is deteriorated. The largest absorption of acid from external sources occurs in the outer edges of the leaves ofthe books. So the edges ofthe leaves of books deteriorate faster than the internal parts ofthe leaves. But the acidic agents present in the paper internally cause internal deterioration.

8.4 Harmful Agents

The harmful agents cause deterioration to paper in particular. In the process of manufacture of paper the raw materials are to be digested to make the paper pulp. Caustic soda and other bleaching materials keep residual substances which create the chlorides • Some chlorides are also left as a result of insufficient washing. Such chlorides cause deterioration of paper. Sometimes the chlorides with aluminium sulphate form aluminium chloride which produces hydrochloric acid in the presence of moisture and heat. All these conditions deteriorate the cellulose content rapidly. The carbohydrates in chemical wood fibres while oxidised cause the degradation of paper. Various types of raw materials as the major constituents of paper are being used. For the digestion and bleaching they require chemical treatment. The undesirable constituents ofthe raw materials, the impurities left over, the unwanted residues of chemical reagents such as, chlorine, sodium hydroxide, sodium sulphate, calcium bisulphite, etc. cause rapid deterioration of paper.

8.5 Foxing

Paper is not a very suitable medium to support the growth of mould and fungi. However, under otherwise favourable conditions, for example, tropical temperatures and high atmospheric humidity, paper will support the slow growth of these micro-organisms, some of which will have a similar action on paper to that ofthe dry rot fungus on wood. Not a good deal is known yet about this type of damage but it is suspected that the brown rot of paper in the tropics and the foxing of old paper in temperate climates are due to a mould which grows in the substance ofthe paper without giving any indication of its presence, except slight browning, until such time as the paper because, brittle and acquires a characteristic.” Spiey” small and marked browrish colour. Foxing in fact is a common phenomenon on paper in the form of brown spots. Foxing stains are the result of chemical action betweenthe iron impurities present in the paper.

8.6 Atmospheric Pollution

Atmospheric contamination is a major cause of chemical degradation in paper. The contaminants involved are the oxides of carbon and nitrogen and, more particularly, of sulphur, which require moisture and free-air circulation to be active as deteriorating agents. Most of the damage caused to paper is due to the oxides mixed with other catalytic agents. The impurities of air are sulpher dioxide, hydrogen sulphide, ammonia, nitrogen dioxide, ozone, aerosols, carbon dioxide, carbon monoxide and other chemical compounds. There are also certain gases, traces of metals, oily substance, and contaminating particles. Dirt, dust and solid particles such as sand and oily soot are the most common solid materials to cause damage. The hydrogen sulphide in contaminated air is produced by industrial gases and wastages, activities in cities, and biological activities. It causes deterioration, though the rate is not high. Ammonia released into air for many reasans is harmful to cellulose fibres. Ozone is generated by the action of ultra-violet light on oxygen in the upper atmosphere. Most of the nitrogen dioxide in polluted air comes from autombile exhaust. Sulphur in the atmosphere in the form of sulphur dioxide comes from the residue after combination of fuel used in domestic and industrial purposes and also from automobile engines. Moisture makes it sulphuric acid, an enemy of library materials. Nitrogen dioxide combines with water in the air, and the result is harmful to paper and other library materials. Leather too, is highly susceptible to damage form acid, Ozone causes oxidation and embrittlement of paper and leather.

The aerasols are minute solid particles suspended in the air. The main source of their existence is carbon from the incomplete combustion of fuel, coal, diesel, etc. Sometimes these are sticky materials, because of the presence of tar. They include suspended ash, soil, dust, fibre fragments, sodium chloride and other particles. Industrial aerosols contain ash, dirt, chemical particles. They absorb and carry with them sulphur dioxide, hydrogen sulphide and iron. They settle on library materials and start chemicl reaction causing deterioration to the materials. The polluted air causes decomposition of paper and binding materials and no library is safe from the impurities of polluted air.

Solid pollutants act on library collections in three main ways: through encouraging biological action, by their abrasive action, and by forming acid. If soild particles contain materials which provide nutrients, then fungi and moulds may grow, causing staining and discoloration. Oily soot can also disfigure in a similar manner. Solid particles can scratch photographic materials, magnetic tape and indeed all library materials.

8.7 Dust and Dirt

The harmful action of sulpur Compounds is aggravated by dust and dirt, which are sources of both physical and chemical degradation. Dust is not an inert material. It hastens atmospheric acid reaction by attracting moisure to cause chemical degradation. Dust mixed

with high humidity is transformed into dirt which is a sticky substance. The deterioration caused by dust and dirt is visible on the exposed part of the books. It is harmful to audiovisual materials and sound tapes and discs. It has been observed that different books stored under identical conditions show different degrees of deterioration. For example, the leaves of volumes which are only from thirty to sixty years old are cracking while those of eighteenth century and even earlier volumes remain flexible and strong. It is therefore evident that the storage conditions alone cannot be responsible for the marked deterioration of the comparatively newer volumes.

8.8 Action of Inks

The history of inks also provides a clue to the acidity due to harmful chemicals used in the production of paper or documents. During the middle ages, carbon inks were gradually supplanted by iron gall inks. Because of the interaction of ferrous sulphate with tannins, sulphuric acid was formed in these inks in varying degrees of concentration depending on the concentration of the chemicals. Documents, damaged by highly acidic inks are commonly found-in libraries and the damage is invariably extensive. It has been observed that inks of high acid content often eat holes into paper, while low acid inks cause no damage. This could be due to the fact that alkalinity of the paper in some cases counteracts and neutralises the acid.

8.9 Effect of Printing

Printing has resulted in the progressive loss of permanence in paper which might have appeared to insure, mainly because of the use of materials such as strand, esparto grass, wood pulp, bamboo, flax, rayon, cotton linens, alphapulps, or a mixture of these, instead of rag for the production of papers of inferior quality which have deteriorated.

It may be said in passing that Mr Barrow’s technique of deacidification seems a wholly admirable development.

8.10 Summary

This unit discussed some of the major factors which cause chemical deterioration to librae y materials. The major causes of deterioration are acid, chlorides, carbohydates in chemical wood, fibres, the unwanted residues of chemical reagents, foxing,, atmospheric pollution, dust and dirt, action of inks and effect of printing. Basically a library constitutes books as will as printed non-book materials which are paper based. Besides these, there are constituents such as audio-visual tapes and discs which also suffer from chemical deterioration.

8.11 Exercise

1. How do acid and acid reaction become the major deteriorating factors to library materials ?

2. How does ink become a source of acidity ?

3. What are the possible, impurities of air ?

8.12 Keywords

Aerosols: A colloidal system, such as a mist or a fog, in which the dispersion medium is a gas.

Fox : To discolour, showing brownish mark.

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Unit 9 ❑ Biological Agents

STRUCTURE

9.0 Objectives

The agents which cause deterioration in the library materials may be broadly classified as (a) Physical agent, (b) Chemical agent, (c) Biological agent. The degrading effect of

physical and chemical agents begins rather slowly and is likely to escape detection at an early stage unless constant vigilance is maintained. Oh the contrary biological agents do harm fast. After reading this unit, you will be able to;

1. recognise the damage caused by micro-organisms and other biological pests
2. know that the growth of fungi is influenced by such environmental factors as humidity, temperature, light and nutrients
3. understand the complete destruction done by common pests.
4. know that man' caused the maximum damage to library materials.

9.1 Introduction

Biological enemies use the library materials as their place for breeding, constituents of books as their foods, materials as their hide outs and dwelling places or they just destroy the mateirals. Many living organisms, animal or vegetable, find nourishment in dead organic matter, which abounds in library materials. Paper, leather and wood, for example, are food sources for a bacteria, moulds, fungi or mildew and insects. Biological agents thrive in condition where there is dust, inadequate ventilation, poor lighting and high temperature and relative humidity.

Library materials are the records of intellectual contribution of mankind and have been preserved by human beings for centuries together. But unfortunately it is also a fact that human beings are the greatest enemies of records of human thought. Great libraries of the ancient and medieval world were worst affected targets of the conquering armies and were burnt in hate by organised vandalism. There were also activities of theft, sale of materials of greedy persons, malicious mischief, careless handiling and utter neglect of new generations. In addition to these acts, riots, delibrate destsruction, looting and mishandhing happened through centuries.

The natural calamities such as cyclone, flood, fire by accident, earthquake, and the like caused much damage to libraries. In various parts of the globe, natural conditions perpetually do harm to library materials, the excessive heat in desert area,'fluctuation of temperature in day and night, hot areas with sand storm, countries having tropical climate, humidareas with rain, low areas with flood and such other conditions posed perennial problems to preservation of library materials. Enemies of library materials may be grouped under two broad categories-enemies within the library and enemies outside the library. Enemies within the library are chiefly the biological agents and enemies outside the library are the natural calamities and deliberate destruction by people for any reasons.

9.2 Common Book Pests

" Often library materials are damaged by pests, fungus and insects. Most of the libraries have suffered the ravages of the agents of biodeterioration. Agents of biodeterioration

include micro-organisms and insects. They are active living, organisms found in housing environment. They sustain themselves with the materials completely, and can put in a state of condition when the doucments cannot be handled or used. The warm humid atmosphere of our country is congenial to the growth of these agents. While the library materials are infested by such biological agents the damage is made very fast more of less permanently. It is therefore desirable to be aware of infestation by certain biological agents like fungi, bacteria and insects, which have been observed to cause damage to library and archival materials.

9.2.1 Microbiological Agents

A group of fungi including Altemaria, Penicillium, Mucor, Fusarium, and others grow in paper. The growth of fungi is influenced by such environmental factors as humidity, temperature, light and nutrients, the two most important of which are relative humidity about 60 percent and high temperature in the range 28°-35(l C. Fungi spores, which are always present in the atmosphere, grow at temperatures near freezing as well as temperature as high as 50°- 5 5° C. But a combination of high temperatures and moist conditions kill most fungi and fungal spores. They withstand prolonged periods of freezing or subfreezing temperatures, and grow and reproduce as soon as temperature and other conditions favourable to their growth exist in storage rooms.

Both light and darkness are conducive to the growth of fungi, so there is little choice between the two conditions in the storage area, Although a certain amount of ultra-violet light is lethal to fungi, it also affects paper adversely.

Moulds and Mildew are types of fungi which obtain their food by sending root-like organs in organic tissues of paper and other materials. They make the paper soft and weak, binding materials eaten and loosened and thus cause damage to books. Fungi attack starches and glue in paper used as sizing elements and thus paper loses its strength. After that they attack the cellulose fibres making paper soft and weak. Starch glue, paste and adhesives are converted into other materials and the paper becomes desized, soft and absorbent as blotting paper. Finally it is reduced to pulp. Similarly, leather begins to rot, and the binding gives way. Fungi also affect inks, particularly iron-gall inks, which are susceptible and fade.

Fungi are also responsible for foxing. It is rusty brown spotted discolouration of paper, particularly of old books. The organic acids secreted by the fungi in course of their metabolic process react with the traces of iron present in paper forming salts that decompose into oxides and hydroxides of iron which are responsible for the discolouration.

Papers vary in their resistance to fungi. For example, machine-made papers are more prone to fungus attack than hand-made papers. This is probably due to the chemical treatment and other processes used during their manufacture. Certain less hygroscopic papers, for example, sized papers, specially rosin sized, and calendared papers, are resistentto fungi attack.

Besides fungi, bacteria also cause decomposition of cellulose in paper and binding

textile These are called aerobic cellulose decomposing bacteria. For example, Cytophaga, cellvibrio, Cellfascienla and Mycobacteria cause discoloration and staining of books and other allied materials. Certain dangerous bacteria live on organic matter, but fortunately, they are rarely found in libraries. When this does occur, it is because the library materials have been contaminated by saliva, mucus, grease and other unsanitary substances.

9.2.2 Insects

Insects, rodents and pests are the dangerous enemies of library materials responsible for damage and destruction to any extent. More than seventy species of insects have been identified as enemies of library materials, The most common of these invertebrate pests are the cockroaches, silverfish and firebrats, termites, book-lice, bookworms, mud wasps, moths and bedbugs. Spiders also cause damage from the bodies of dead insects trapped in spiderwebs and from the dead spiders themselves. Insects feed oh organic substances such as cellulose in paper, pastes, glues, gelatin sizing, leather and book cloth. They prefer warm, dark, damp, dirty and poorly ventilated conditions. Siliverfish and book-lice need moist condition.

Rodents and other animals are the final category of biological agents. Cats and dogs should not be encouraged in libraries as they provide nouishments for insects in the form of hair, secretions and dead parasites, such as fleas.

9.2.3 Cockroaches (Blatta-Orientalis)

Over one thousand species of these loathsome creatures exist in the world, with the majority living in tropical and semitropical climates. Fortunately, only five varieties are likely to be found in libraries. They conceal their broad, flat, brown or black bodies in cracks and crevices by day and erergy at night to forage. A favourite food is the paste and glue in book covers and they will eat through the cloth and paper spines of shelved books to get at it; they rarely penetrate into the interiors of bound books. They excrete a dark liquid which discolours any material over which they crawl. The females carry their eggs in pouches on their bodies and deposit them where food (filth or otherwise) is available, and where temperature and humidity are favourable. They are omnivorous, feeding on paper, board, binding textiles, leather specially attracted by binding glues. Moist air, warmth and darkness form most favourable condition for their breeding and growth.

9.2.4 Silver Fish (Lapisma Saccharina)

Silver fish is slender, wingless, sealed insects that grow to lengths of one -half inch at maturity. It is pearl gray and has two antennae and three tail-like appendages. They are sometimes seen in the daytime and are most active at night they prefer damp walls and cool basements. They are very fond of stiffen and gelatine and eat book covers to get these materials. They also eat paper for starch and carbohydrates. They breed very frequently.

They lay eggs in dark spaces behind books and behind papers in drawers and cabinets; The. eggs are hatched in two weeks and if temperature and humidity are favourable, another generation can be spawned within three months. They are also known as silver moths, sugar lice, sugar fish, fish moth and slickers. Silver fish damages the surface of books and eat binding fabric, leather board and adhesives, thus cause much damage to library materials. It is very difficult to get rid of them.

9.2.5 Firebrats

Firebrats are also slender, wingless insect of about half an inch length at full maturity. Colour of these insects is mottled gray and they look like silver fish. They prefer warm areas They are cone-shaped, swift running noctural insects. They breed very frequently. They eat binding materials, starch, adhesives and cause much damage to paper and bookbinding. Although they are sometimes visible during day time, they are most active at night. They eat through book covers to get the glue beneath.

9.2.6 Termites (White-ants)

Termites thrive in tropical and subtropical climates. Although superficially resembling ants and sometimes called “white ants” they are neither white nor ants. Almost nineteen hundred species have been identified. Earth dwelling termites invade buildings by constructing mud tunnels across masonary foundations and between walls and fipors. After gaining access to a building, they can do terrible damage in a matter of days. They are difficult to detect because they attack from the backs of cupboards and bookcases and eat their way through wooden shelves and into the interior of books. After having taken possession of a book or a drawer of paper, they do not stop eating until the contents are digested and wastes excreted, leaving a mass of pulp where once were printed pages. Termites are voracious eaters of almost everything in the library.

The dangerous aspects of their behaviour are that the extent of damage caused by them cannot be detected, because they after the misdeed move to back and remote corners of furniture and building. They do damage by thousand in number. They can destroy materials with enormous speed, They can do terrible destruction in a matter of days. They do not stop their work until all materials are completely destroyed. Since they avoid exposing themselves,. they are seldom seen until great damage has been done. They do not like any obstruction in their way, and they make their passage by penetration through anything standing in front of them. The infestation by termites is usually detected only when the result has become most damaging and destructive to the library materials including wooden furniture.

9.2.7 Book Lice

Book lice, also called psocids, are minute gray or white insects no longer than a pinhead that sometimes exist by thousands between the pages of masty books. They appear

in buildings in great numbers in late, summer and fall and seek damp, dark areas. Eating almost anything, they are found wherever vegetable of animal matter is allowed to collect. In musty books they prefer the microscopically small fungi in the paper rather than cellulose, gelatine or glue. They are a nuisance but do little actual damage to library materials. However, their presence should be a warning that conditions are developing that will soon attract the more dangerous library, pests.

9.2.8 Bookworm (Coleoptera)

Bookworm is a generic term that includes a number of beetles found in libraries. In libraries the beetles lay their eggs on the edges of books and seem to prefer the bottom edges, next to the shelves. After the eggs are hatched, the larvae eat their way into books, making tunnels in the pages and boards. These grabs exude a glue-like substance which often cements the pages together. Their excrement is a fine dust which is found in turnels and on bookshelves. Bookworms devour printed pages and the text becomes unreadable. The pages become badly damaged.

Bookworms cause the damage in two ways. They make tunnels in the books, eat up the paper making the passages almost breakable and unreadable. They are also responsible to stick the pages together so firmly, that these are badly damaged when pulled apart. They are voracious eaters of all kinds of materials used in the making of book. They conceal themselves so easily that they are rarely found to combat against.They do harm inside the book first, then come, to the surface. So, when the outer damage appears, it means that damage and destruction have been done inside the books. The damage is done very rapidly.

9.2.9 Moths

The brown house moth is abundant everywhere in the world except Africa and South America. They are dangerous to. book covers. They eat cloth and leather covers of the books. The larvae are white, hairless. Darkheaded, half-inch long worms that eat cloth and calf-skin covers on books, For some unknown reasons goatskins are immune. The winged adults lay their eggs in cracks in floors and walls and any other concealed place. They breed four generations a year in warmer climates.

9.2.10 Rodents

These gnawing biting animals found all over the globe, include mice, rats, rabbits, and many other species. Rodents are occasional visitors to the library. In libraries they eat anything made of paper, leather, vellum, glue, paste, gelatine and the like. Once established in a building, particularly an old one, they are very difficult to exterminate. Although they prefer to nest between walls and in dark recesses of cellars and attics, they have been known to rear their young in infrequently opened closets, desk drawers, book-cases, and cabinets.

Rodents are biting animals found everywhere. They pose the most difficult problems in the entire fied of preservation. Rats and mice may have about fifty offsprings a year and if they feel conve.-ieu, thousands of rats can live in the basement of the building and can move throughout the buildings in all its floors. If settled they grow very quickly in number. Rodents attack books and other library materials mechanically and mercilessly. They do much harm in a consolidated effort by a large number and cut into pieces anything they get. Toxic materials in the paper or insect- repellent are not effective in case of rodents. They just come out in the light, make the damage and destruction, and conceal themselves. Their presence can be recognised by the traces of their movements and damaged papers.

Rodents are very quick in their action Even in a single night they collectively can cut, a part of the library collection into pieces. If they work undisturbed, they can destroy any amount of total holdings of the library. They do not eat and digest the library materials; they just destroy them by cutting into pieces, which cannot be repaired and restored in their original condition. Mice are not as loathsome or dangerous as rats, but are a nuisance in libraries, because of the damage they do to paper, which they fancy for nest making and because of the droppings they deposit.

9.3 Human Beings

Human beings are also responsible for the deterioration of library materials. Human involvement can be indirect, polluting the air or accepting poor manufacturing practices and inferior materials. It can be direct; we abuse books by deliberate programmes—burning, looting and vandalism, and by less dramatic but equally harmful means such as theft, careless reading habits, thoughtless handling Damage caused by human beings may be examined in four areas: population growth and increasing use of library materials, attitudes towards libraries and books, new technologies and abuse and mismanagement.

One result of the exponential growth in the worlds population over the last four centuries is that more people have been chasing fewer copies of books. This is particularly the case for the finite quantity of books produced before, say, the middle of the twentieth .century. Concepts of democracy have become more widespread in recent times, with one consequence being the greater accessibility of and gerater need for information of all kinds. In more specific terms increased openness has led to the growth of open stocks in libraries, and the active promotion of library use, making the contents of libraries more acessible, and making them comfortable and attractive place. The inevitable consequence has been a rapid deterioration in the physical condition of the collections.

Heavier use of library materials has also occurred because of the dramatic increase in the numbers of periodicals and books, the so-called information explosion: One would expect that the increased member of items available for use might result, overall, in less use per item,but this/has not occured. Libraries have been facing static or only slowly increasing

budgets and have been responding by developing subject specialisation and resource sharing arrangements in the process of resource sharing.

Changing attitudes towards books are another cause of damage. Library mate rials are handled by users in a destructive way.

Mass production techniques have had severly deleterious consequences on the quality of library materials. In a short time the paper discolours and beecomes brittle, the adhesive cracks, pages fall out soon.

New technologies have resulted in greater deterioration of library collections, imposed at a faster rate; We drive cars and ride buses and the resulting air pollution contributes heavily to paper decay. Finally we note the abuse and mismanagement of libcarjwnateirals as major contributions to, their deterioration. Both staff and users abuse library materials, careless handlings is one major cause, Much photocopying is destructive with bindings being forced down hard into the platen of the photocopier. Sometimes library personnel may cause the damage by adopting wrong preventive measures by using improper materials for repair and restoration and also by carelessness and improper storage. The cumulative effects of all these conditions cause much harm to library materials.

9.4 Other Destructive Agents

Natural calamities, accidents and human acts are the enemies of library materials. Natural calamities are cyclone, typhoon, flood, earthquake, storm, etc. which can cause devastating loss to libraries. Accidents like fire are very destructive because most of the library materials are highly inflammable. Rain water by accident can soak library materials and it is very difficult to restore them. Human deeds, as noted earlier also cause destruction of library materials. In case of war, bombing, riot, etc. the parts or whole of the library may be destroyed. Theft of library materials is also a misdeed causing dismemberment of library materials.

Much knowledge is available about the enemies of library materials, rare of otherwise. It behooves the libraian, regardless of the function of his organisation, to familiarise himself/ herself with those he/she can be expected to encounter and to use the means at his command to control them.

9.5 Summary

Here we have discussed the agents of Bio-deterioration which include micro-organisms and different insects. The destructive nature of rodents has been highlighted. Damage caused by human beings has been examined in fouf distinct areas. Among other destructive agents natural calamites, war, riot, have been explained in detail.

9.6 Exercise

1. What are the Biological agents responsible for decay and deterioration of all kinds of library materials ?

2. How do fungus and book worms cause harm to books ?

3. How do human beings cause harm to library materials ?

9.7 References and Further Reading

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Unit 10 ❑ Environmental Control

STRUCTURE

10.0 Objectives

Researches are isolating the enemies of library materials to find out exactly what they are and why they act as they do. Preservation emphasises prevention to avoid costly repairs and restoration. Rapidly increasing knowledge in thefield cautions us not to rely too heavily on the older methods of conservation. After reading this unit you will be able to;

1. understand that prevention is better than cure

2. know that the proper storage environment holds in check the growth and development of injurious biological pests.

3. understand that the causes of deterioration can be controlled to a great extent by the. environmental control.

10.1 Introduction

Once the books, documents and (heir materials are affected by physical and chemicals factors or infested by the biological agents and damaged, it will be very expensive affair

to repair, rehabilitate and to restore these materials making them usable physically in terms of money, time expertise, working hours, personnel and the like. It is pact what the meterial cannot regain their original shape, health and physical usability in spite of all the best efforts. While affected the library materials become ill and they need the treatment compared to medical treatment. Their illness should be cured and their health must be restored to make them capable to be used physically.

10.2 Aspects of preservation

There are two aspects of preservation: the preventive measures and the curative measures" The preventive meassures include all the methods of good housekeeping, adequate caretaking, dusting, cleaning, periodical supervision of the storage, pervention of any possibility of damage by physical, chemical, biological and other factors, use of repelling agents, chemicals and insecticides to drive away the biological factors, and on the whole the control of deterioration and damage of library materials.

The curative measures are taken when it is found that the preventive measures have failed for some reasons and the library materials are affected and damaged by the causes of deterioration and the enemies of library materials. The curative measures comprise mending, repairing, rehabilitation, deacidification fumigation, lamination and other ones as required in view of the physical condition of individual document.

Preventive masures must be taken adequately in the storage areas for the library materials. In storage areas books and other materials are kept for a long time or permanently so long the library exists. Preventive measures are the continuous efforts and methods adopted to keep the materials in good condition. The normal aging of the library materials is inheritable. The library materials are being used and the repeated uses of books and other materials cause some physical deterioration. Notwithstanding all these conditions, if adequate care is taken and preventive measures are followed, the longevity of library materials will be longer and more users will be able to use the materials for a longer period. Such condition can be created by taking care of the materials and through good housekeeping.

After ascertaining the nature of enemies of library materials, the first objective is the creation of an environment in which these enemies cannot exist. This includes temperature and humidity control, the removal of aerosols and noxious gases from polluted air and good housekeeping. Other factors to be considered are lighting, storage conditions, control of vermin, the use of fungicides, ventilation and routine care of library materials. The causes of deterioration can be controlled to a great extent by the enviromental control.

10.3 Environment Control

Recogonising the fact that there will be natural deterioration and decay of library materials, measures should be taken so that such deterioration can be checked, retarded and

not accelerated. Usually physical and chemical factors cause such deterioration. The causes of deterioration are heat, light, darkness, moisture, acid reaction, dust, harmful chemicals, atmospheric pollution and soon, These causes of deterioration can be controlled toa great extent by the environmental control. Damage by the enemies of libraries can be controlled by this way.

10.3.1 Building

Practically, the environmental control begins from the planning and construction of the tibrary building. The site the library building, the soil on which it will be constructed, the efivironmental setting of the building and such other factors have the impact over the environmental control inside the building. In case of a new building soil of the site should be tested and insecticides should be applied adequately to the soil on which the building will be constructed so that the growth and access of the visiting pests are totally controlled. The building should be properly designed and planned to create a congenial atmosphere inside for housingthe library collection suitable. The architect or the consultant must consult the librarian at every step of planning and designing the building which will house the library collection permanently. Every library building is a functional building and the librarian knows his requirements best. The housing requirements should be properly taken care of considering the causes of deteriroation of library materials.

If the library building is an old one, the existing building can be suitably modified and restructured to facilitate environmental control. Insecticides should be applied on the floors and corners of the building cracks, if any must be repaired; The incoming of visiting pests can be controlled in this way. If required the fine wire mesh should be filled to the windows, there should not be any drain pipe hole in storage area, Frequent white washing minimizes moisture. Coloured glass panes, usually yellow or green and cartains should be used in the windows to control ultraviolet rays and other hamful rays of direct sunlight, rain water and dust coming from outside.

10.3.2 Light

Paper documents require light but not direct sunrays. They also require proper ventilation of clean air as far as practicable. Heat should not be allowed in the stock area. Moisture should be controlled fully. There should not be any stagnant air in the storage area and darkness should not be allowed The window of the staok areas should be vertical and never horizontal. By this way direct sunlight having ultraviolet rays will not do any harm to library collection. In this way access of rain water can be controlled. Shelves should be placed in between two windows against the walls. Direct sunlight, rain water and high moisture will not affect the materials directly. Stack rooms should be will ventilated and will lighted. Book should be placed at a considerable distance from the walls so that moisture of walls cannot be affect the paper and other materials.

Light, darkness and air are both enemies and friends of library collection. Direct sun rays, bright light, both natural and artificial, do harm to paper. But light is nessary in the storage of fungi and mould and grouth of insects. Darkness is neassary because excessive natural and artifical light discolour the paper. At the same time darkness is congenial for

breeding of insects. It is advisable to keep the book storage area under lighting condition during working hours and in complete darkness during closed hours. All sides ofen double-faced book shelves made of steel should be used for book storage. This will ensure paper lighting and ventilation of the book and will minimize darkness in the corners of the shelves. Covered almirahs should not be used for book storage because adequate light, air passage and ventilation are not possible.

10.3.3 Central Air-Conditioning

In terms of conservation, nothing will give greater return than an investment in air-conditioning and a carefully planned and rigidly supervised programme of housekeeping. Air-conditioning is expensive but the cost of book binding, repair, -restoration and replacement are higher. Cellulose materials are susceptible to deterioration by hydrolysis, oxidation and photosysethesis. Conditions are accelerated by heat and moisture, the degradation can be minimized by the control of temperature and humidity. The air-borne aerosols and noxions gases and harmfiil chemical agents should be controlled as far as practicable to diminishthe chemical deterioration oflibrary materials. The ideal temperature in the storage area should be between 20° C and 24°C and the optimum humidity should be between 50% and 60% relative humidity The most practical way to control temperature and humidity and clean air is by central air-conditioning. Air-conditioning keeps air borne aerosols, gases, chemical agents, dust and other environmental pollutants away. The four functions of air-conditioning are ventilation, filtration, temperature control, and humidity control.

10.3.31 Ventilation

From the point of view of conservation, oxygen must be classified as a noxious gas. It supports the lives of people in libraries, but it reacts dangerously with paper, leather, film and other materials. Fortunately, this oxidation, with the exception of certain films and other plastics, is a slow process under the conditions normally encountered in libraries.

10.3.32 Filtration

It is possible by filtering to clean urban air of contaminating aerosols and noxious gases, minimizing the grime, abrasion, and chemical deterioration they normally introduce. Suspended aerosols are screened from air by filters, spunout by cyclone devices or precipitated electrostatistically All can be effective, but filters are the least expensive. Because contaminated air is let into building every time a door or window is opened, it is pointless to require cent percent effectiveness in air filtration. Such efficiency would also be extremely expensive because of the power required to pump air through the denser filters that would be required and the cost of their frequent cleaning. Sulphur dioxide can be partially removed from air by frequent recirculation through activated charcoal filters. Ozone can be removed from air by expensive electrostatic precipitation.

10.3.33 Temperature Control

For the health and comfort of people, indoor temperature must.be kept between 20˚C-

25°C. During the dry summer months when the heat is considerably high the window of storage area should be kept closed. Windows should have coloured glass panes. If windows are opened wet khas or curtains should be used. Floors of storage area can be cleaned by wet dusters.

Exhaust fans should be fitted to the stack rooms. High speed air circulators should be used in the storage areas, After sunset windows may be kept open till the closure of the library hours.

10.3.34 Humidity Control

People can tolerate wide ranges of change in humidity, but because of the sensitivity of organic materials to moisture changes, relative humidity in libraries should be kept within reasonable limits. In tropical countries a major problem is the atmospheric humidity. High humidity is the root cause of various types of deterioration and damage. The preferable condition is to keep the humidity level below 70%,

It is a desirable to keep a hygrometer in a convenient place in the storage area. A hygrometer consists of two thermometers, one dry bulb and one wet bulb. The relative humidity is calculated on the basis of the differences between the readings of two thermometer's. It is also desirable'to keep one thermometer to measure the temperature, so that the relative humidity with temperature ,can be recorded and observed. If the humidety is recorded about 70% or beyond, this should be brought to about 55% by using dehumidification measures. Regardless of the type of control, it must be reperated continuously, day in and day-out, to maintain acoustant moisture level.

Free circulation of air and in some cases dry artificial heat by the use of electric radiators for extreme conditions may be effective. In our country the adverse conditions are too severe, the enemies are too numerous, but the available resources are too scaut. Under the circumstances, the preservation problems faced by the librarians is more challenging than in the developed countries.

10.4 Housekeeping

Environmental control is the comprehensive measure for good housekeeping. Good housekeeping means avoiding dampness, stagnant air, high temperature and high relative humidity. Since repair and restoration of library materials are very expensive rigid supervised programmes for good housekeeping are all the more necessary to check the damage and minimize deterioration. A cleaning schedule establishing order of priority, sequence of operations, and daily and weekly routines should do much to insure that all of the spaces in library get their share of attention. Additional specific instructions forgetting into remote corners, behind cabinets and under desks to remove dirt and refuse which harbour vermin, would be equally useful, if supervision is clo.se enough to ensure compliance. Frequent inspections by key personnel are of great value in the battle against dirt.

Regular periodical dusting of book-shelves should be done as a routine work. The best

way is to use vacum because it sucks the dust and thus dust cannot resettle on the bookshelves. If it is not available routine dusting should be done frequently for the bookshelves. Floors should be dusted regularly with damp cloth.

Generally books in good condition and books recently acquisitioned should be-dusted by soft cotton duster. But books should not be dusted which kept on shelves. A small table should be kept nearly and a number of books taken from the shelf should be placed on it. Each book should be dusted and kept apart. Then the cleaned books should be placed on the shelf. In this way all the books should be cleaned. When books are taken from the shelf, the sheaf itself should be dusted with clean duster and solution of 2% formalin or any substitute should be used to wipe the shelf. This can be done by cotton swabs dipped into the solution and squeezed to near dryness using hand gloves. The dusting of books should be done by wiping the edges, spine and dust jacket by opening it. Since more dust is accumulated on the upper edge and settle on it, dusting should beging with upper edge. The side edge should be cleaned in a downward movement, and them the bottom edge should be wiped. After that the spine should be cleaned along the cover and dust jacket. The movement of the hand should be away from the spine. Each book should be examined by opening it whether any kind of deterioration has started, particularly biological infestation.

If books are found to be dirty and there is any proof of existence of mould or fungi growth or infestation of any kind of worm, books should be cleaned leaf by leaf. In that case the exterior and the interior of the covers should be cleaned with cotton swab soaked and dried with 2% formalin solution or 4% thymol solution in alcohol. The latter solution is effective for leather bound books. The cleaning of accumulated dust, dirt and insect excreta or other contamination should becarried out with a brush. In ease of mould or fungi infestation 2% formalin solution should be used with near dry cotton swab. Then the leaves should be cleaned with dry cotton swab. All thesejobs should be performed on a sheet of paper so that dust and mould particles can be thrown away. When then formalin solution is used the leaves of the books should be dried before keeping them on the shelves.

An inspection team comprising trained persons should be formed in the library. They will inspect the library collection periodically as a routine work to detect unserviceable books and affected or infested books. These books should be treated in the way described above, or if required should be removed from the shelves for adequate treatment depending on the conditions of the book and the extent of damage and deterioration. Books should be grouped as dirty, mould or fungi infested and insect infested. They should be treated accordingly. The persons engaged in inspection should do the job periodically as a routine matter and must take each book from the shelf, examine inside the cover spine and in case of doubt opening the pages. Whenever required books should be segregated from the library shelves. Flags should be inserted in the books like book marks showing the nature of infestation and suggested treatment. Books with the following conditions should be segregated :

(a) mould or fungi infected showing mould stains and deposits.

(b) Books with insect infestation such as, round or oval holes on the spines, inside the

covers and leaves indicating the existence of book worms and larvae.

(c) Books with pages stuck together either by fungus attack or by moisture.

(d) Books having chemical deterioration.

(e) Books with physical deterioration.

All these books need proper treatment according to their conditions. Then such books will be disinfected and cleaned and wi!l be replaced on the shelves.

Not only the book shelves but also stack rooms should be disinfected twice or thrice a year. Rooms should be kept clean. The walls, roof and floors should be regularly dusted. It should be ensured that there is no drain hole for entry of hermfiil pests. Walls and corners should be checked so that there are no dwelling places for termites or other insects. The roof, if it is upper most, the water pipes, the drain water pipes should be kept under pood repair. Periodical technical supervision of the storage areas should be conducted. Walls, ceilimgs, floors should be disinfected by spraying insecticides periodically. General disinfection of the stack rooms can be done by D D T (Dichlorodipenyl-trichloroethane).

DOT may be applied as dusting powder, aqueous emulions prepared from liquid concentrates or from pastes, aqueous enulsions of D D T powder, and solutions in organic solvents like kerosene, turpentine, etc. D D T can abe applied on the walls ceiling and floors by spraying of aqueous emulsious. DOT powder can be applied to the floors, shelves, cabinets or any surface. DOT solution in organic solvent can be applied to books particularly in the spine and inside covers.

Wooden shelves or elmirahs should be sprayed with creasote or 5% D D T in kerosene. If almirahs of closed storage furniture are there insect repellents can be used such as napthalene balls or bricks, thymal, camphor, small quantity of paradichlorobenzene. The following meterials also can be used as repellent and disinfecting agents depending on the condition.

Gammexine Powder

1 % Mercuric chloride in water for wooden furniture

2%-3% penta-chloro-phenol in Alcohol

2% Aldrin, Dialdrin in water

Sodium arsenite solution : 1 part in 9 parts of Benezene 50 cc or Creosote 50 cc.

During the period of high humidity, particularly in monsoon time the atmosphere in the storage area becomes very much vulnerable to biological damage. It required, the atmosphere of storage ; area can be sterilized. An amount of 10% thymol may be mixed with alcohol to make a solution which may be sprayed in the room to deep a cheek on the growth of spores present in the storage area. The roon thus sprayed should be closed for 24 hours. During the long period-of closed house the gas will pervade all over the room. A liquid of 10% and 90% methylated spirit may also be used for this purpose. This treatment is harmful to human beings and should not be inhaled. Adequate precaution should be taken while spraying.

10.5 Summary

In this unit we have discussed two aspects of preservation—prevention measures and curative measures. The cause of deterioration may be controlled to great extent be environment control. The causes of deterioration mamely, heat, light darkness, moisture, acid reaction, dust, harmful chemicals, atmospheric pollutions are discussed in details. Environmental control ensures good housekeeping.

10.6 Exercise

1 Diflferenciate between preventive measures and curative measures
2. What isunderstood by ‘Environment control’ ?
3. What do you mean by ‘good housekeeping’ ?
4. How would you achieve ‘good houskeeping’ ?

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Unit 11 ❑ Control of Micro-biological Agents

STRUCTURE

11.0 Objectives

The problem of insect control consists of (a) keeping insects out, (b) restraining them once they gain access to a library, (c) destroying them when they have settled in the room and inside the library materials. After reading this unit you will be able

1. to indentify the micro-biological agents
2. to understand the favourable condition for the growth of such agents
3. to know how to adopt preventive measures to keep them out.

11.1 Introduction

Insects need not be a problem in libraries, where good housekeeping and sanitation are the rule if all incoming materials, including returned books as well as new acquisitions and donatioins are examined carefully It would be ideal if all new items could be vacuum fiimigated but the cost of the necessary equipment rules that out for most. Effective fumigation is obtainable by the use of less expensive, but also less efficient, chambers. A third alternative is to examine each incoming book page by page and to serutize all other incoming materials and supplies. When this searching uncovers winged insects, larvae or pupae, they can be destroyed by spraying.

Fungi, mildew, mould together with bacteria are known' as microbiological agents. The favourable conditions for growth of such agents are atmospheric temperature, humidity, darkness, and nutrients in library materials. The major factors are temperature and humidity. Therefore environmental control and good housekeeping are the proper meaures to control and good housekeeping are the proper measures to control them. There are the most important preventive measures. In spite of all these precautions, if is found that microbiological attack has occurred, the condition can be prevented by the use of preservatives or by treatment of fungicides. But the trouble faced by the librarians is that microbiological agents vary enormously in response to toxic chemicals. It has been experienced that some type fungi can tolerate high concentration of certain fungicides while others succumb to low concentration.

11.2 Control of Micro-biological Agents

It is not always possible to know the species of fungi and the right fungicides by laboratory experiments. Depending on the infestation of materials some fungicides may be applied. But high concentration of chemicals should not be used because it may cause harm to library materials, for its toxic effect. As a preventive measure low concentration of different chemicals can be used. Generally the following chemicals may be applied after cleaning pages of the books and other paper materials. These are mercuric chloride of 0.2% concentration, pentachlorophenol of 0.25% concentration, 3%-5% paranitrophenol, 5% theymol and sodium fluoride, 10% sodium solicylate, 10% sodium pentachloro phenate. Besides these, a wide variety of organic and inorgenic compounds and chemicals are currentty used to prevent microlilogical attack. Among them (he most effective agents are formaldehyde, para-nitrophenai, boric acid, salicylanilide, ortho-phenyl phenol, acetone, lecta-napthol, 2-hydroxy-diphenyl amine, thymol, cthylene oxide, and chloramine-T. The fungicide should not be used indiscriminately. During the preventive measures the nature of paper, reaction with other chemicals, cost, availability, volatility, ardour, the safety aspect of human beings, extent of infestation, ect. should be taken into consideration,

Pentachlorophenol and ortho-phenyl phenol have been proved to be wide-ranging fungicide and a low concentration preservative for destaiction of various types of fungi. Moreover, these are stable and do not interact with other chemical substances. Both are souble in wate; and alkaline. Tissue paper soaked in the chemical solution may be used for interleavring between leaves of documents. The same sheet may be used as long as nine months to one year depending on humidity. Thymol is good inhabitant for mildew growth. Two very effective fungicides are sodium salt of phentachloropenol (santo brite) and sodium salt of orthophenyl phenol (topane). All these chemicals may be used as repellent or perservative and destructive while documents are dameged in various concentrations. These may be applied on book shelves or sprayed on bookshelves and books. Such preventive measures may be taken for both fungus attack and insect repellent.

11.3 Pest Control

The real damage and destruction are done to library malerials by various types of insects and pests. Even they can do harm beyond the knowledge of the library personnel. First, these insects and pests are mostly noctural in nature, they do the damage during the closed hours of the library. Secondly, they do the harm even complete destruction from within the materials. There may not be any external proof of damage. Therefore, only environmental control and good housekeeping are not helpful to control insect damage. There should be periodic inspection of every book and strict vigilance over the walls, ceilings and floors of rooms as well as over the bookshelves particularly the valuable pockets of storage area.

The preventive measures of insect repellent are usually taken as a part of housekeeping. But in spite of all these measures taken it is found that insects do get into the library, breed enormously and damage the materials in various wags. The condign can be improved by periodic supervision and strict vigilance. Whenever it is detected prompt and positive action should be taken to control and eradicate them. Silver fish, firebrats, termites, bookworms, cockroaches, and other insects cause wide and devastating damage to library materials even in larvae and beettle stage. Primarily such attack can be controlled effectively by spraying the walls; ceilings and floors with dialdrin 20% solution with water. This spray continues to stay for atleast two years and will kill any insect in contact.

Cockroaches, silverfish, firebrats, mosquitos and bookworms in the battlestage can be controlled effectively by spraying the walls, woodwork, floors, ceilings, interiors of closets or using dust containing 5% DOT or Pyrethrum. Amixture of equal quantities of paradichlorobenzene, benzene and creosote (P.B.C) can be used as effective.repellent. For the control of book-lice pyrethrum spray, P. B. C or paradiehlorobewzene can be used.Book-worm beetles cannot be controlled by only external contact. The affected documents be controlled b> only external contact. The aifected documents should be fumigated by P. B. C. vapour, fumigation with ethyl or Methyl Bromide of fumigation with carbon-disulphide. Cockroaches can be controlled by spray of dust containing 5% DOT, pyrethrum, Sodium Fluoride and Gypsum (1:1) as poison powder. P. B. C. may be used as repellent. There are some commercially available insecticides under the brand name of Finit, Baygon spray, Sheltox, Pip and the like. These can be sprayed on the book shelves to control insect attack. The poisonous powders or insecticidal liquids should be applied or sprayed on the infested areas, book shelves, walls, dark corners, remote places, crevices, etc. A caution should be noted that these materials should not be used directly on the documents which may be harmful at the time of handling,

Air-conditioned steel and concrete buildings are generally safe from earth dwelling termites. Older buildings are not, unless protective measures are teken by professional exterminators. Earth-dwelling termites that gain access are quit readily poisoned by the application of insecticides near their tunnels, on top of their nests, or in cracks and crevies in floors and walls. Because termites lick each otheir bodies and devour their own dead,

they assist in their own destruction if enough chemicals are placed near their nests or tunnels.

Wood-dwelling termites can be excluded by light building construction and window screens, but once they gain access, only fumigation will rid a building of them. This calls for professional assistance. If hydrocyanic gas is used, the building will have to be sealed for 48 hours and then aired for 48 hours more before it is safe for human entry. If it is not feasible to close a building for four days, a less effective job can be done in 24 hours with methyl Bromide.

When termites are known to have gained access to a library, a temporary measure to keep them out of the books is to move the wooden shelver away form the walls and stand them on plates of metal or in dishes of coal tar or hexachloride, Chlordanc, Sodium arsenite, Pentachlorophenol, DOT can protect the materials, if these are removed, and insecticides are applied near and on the top of the termite tunnels, floors and walls where they have access. On the infested areas white arsenic, 5% DOT powder of solution, 1% sodium arsenite solutipn in water can be applied.

There is no effective chemical spray or powder for book-worm larvae because of their burrowing. They must be destroyed by fumigation in a vacum fumigation tank, fumigation chamber, or a sealed area, with hydrogen cayanide, methyl bromide, carbon disulphide or other lethal gases. Book varnishes containing insecticides are no longer required.

Book lice (psocide) are soft-bodied insects that succumb when they are subjected to heat and dryness. Hence thorough airing on a hot, dry day of an infested room and everything in it will usually eliminate a mild infestation of these mites. If they persist, their, breeding places, such as a mass of damp paper or old rags or upholstered furniture may be looked for.

Fungicides for mildew control are palliative only and in temperate climates should be used only until the heat and dampness encouraging the growth of spores are brought under control. In tropical countries where air-conditioning is not available or its use not feasible, librarians must rely on chemical to keep milden under control.

The best protection from rodents is to seal off their entry and their access to library building. They do much harm in the old buildings in particular The walls and floors of the building should be strong, all holes, cracks, etc. should be plugged, strong iron nets should be fitted at all drain points. Dark and damp basement, unused or little used floors, closed “godowns, etc. waste and debris, spilled food particles outside the building are the favourite areas for their access and growth. Such conditions should be eliminated. In any way, their entry to the building must be checked totally.

If rodents get access to building for any reason the preventive and control measures can be adopted by poisoning and trapping. Poisons can be used, with baits which should be scattered throughout places frequented by rodents. The food particles can be used as bait with poison. Some of the effective poisons are Zinc phosphide (3% -5%), Arsenous oxide (10% - 15%), Barium carbonate (10%-15%). Commercial poisons sold under trade names can also be used. The best way is to use bait within the trap. But the choice of bait and

poison should be changed occasionally. Otherwise once they are trapped or are in contact with poison but kept them free they will avoid both bait and trap. There are Barium derivatives of nitro and chloro phenols. Merceptobenzo thiozone, nitrogen and sulphur are effective repellent for rodents. In general Zinc phosphide, arsenic oxide, calcium cyanide dust may be used as rodenticide; One caution is worth to note for all the time that chemicals and compunds particularly used for termites and rodents are harmful to people. These must be used only by specially trained and experienced persons under carefully controlled conditions after proper planning. All these are more or less lethal chemicals and all the chemicals and compunds are not of identical nature. Particular chemical with appropriate concentration and if required, solutions should be used for specific purpose. Proper expertise is essential for application and instruction.

11.4 Summary

In this unit we have discussed the control of micro-biological agents viz. fungi, mildew, mould and bacteria. Environmental control and housekeeping are the main factors for then-control. Low concentration different chemicals can be used for control the of these agents as a preventive measure. Insects and pests are mostly noctural in nature, they damage library materials dyring the closed house of the library. Moreover, periodic inspection and strict vigilance should be arranged. Air-conditions steel and concrete building are safe from earth dwelling termites. Book-worm larvae vacuum fumigation. For rodents can be controlled by poisoning and trapping. Chemicals and compounds should be used by trained and experienced persons.

11.5 Exercise

1. How would you keep mildew in libraries under control?
2. How would you save library materials form complete destruction ?
3. How would you control cockrooches, silverfish and firebrats in the library ?
4. What are the micro-biological agents ?

11.6 References and Further Reading

1. Chakrabarty, B. and Mahapatra, P.K. : Library collection: Selection and presowation world Press, 1991.

2. Kathpalia, Y.P. conservation and restoration of archive materials, pans, Unesco, 1973.

Unit 12 ❑ Rehabilitation of Documents

STRUCTURE

12.0 Objectives

The best method of preserving the library materials is to preserve them in their original form. Obviously the selection of library materials has a vital role to play. This implicates the physical properties and the basic constituents of the materials irrespective of their kinds. If the intellectual content of the materials is vital to build up the library collection equally important is the physical constituents of the materials for preservation over a long period of time. After reading this unit you will be able to :

1. understand that certain curative procedures need to be taken to restore the longevity of the documents.
2. know that various types of damage require different types of chemicals and curative measures.

12.1 Introduction

The permanence and durability of the materials are of primary concern of the librarian to keep the library collection usable to his clientele. Therefore, while selecting the library materials for building up library collection the physical aspect should be considered meticulously. It may not be always possible to assess the. physical aspect by external examination. But books should be selected with good quality paper, hard cover and durable binding. In case of non-book materials the reputation of the manufacturer, specifications of base elements, quality control, manufacturing process, methods of recording and the like should be considered carefully. All these may reduce the intrinsic factors of deterioration and will cause minimum problem for preservation.

Yet, in spite of the best efforts of the librarian by making arrangements for environmental control, good house keeping, preventive and protective measures to control deterioration and damage, some part of the library collection may be deteriorater or damaged by chemical factors and in particular by biological factors due to unaviodable circumstances or because of many reasons. In such cases proper curative measures must be taken. The second best method of preserving the library materials is to rehabilitate them, repair them, restore them and to bring them to a condition which is nearest to their original physical form as far as practicable.

It has been observed in the continuous laboratory experiments and research in preservation that the paper documens in particular can be preserved over a long period

under a favourable environmental condition if the document are rehabilitated by fumigation for fungus attack or insect damage, deacidified, adequately repaired, and when required, properly laminated. These are the curative procedures taken to restore then long vity of the documents, if the curative procedures are not taken, the documents will be damaged, destroyed and lost for ever. While it is found that the documents have been affected and they need curative measures, the documents should be segregated from the library shelves and kept in a room meant, for preservation.

Documents as they arrive at the repository for storage are sometimes in a dilapidated condition and require minor repairs, etc. to put them in a proper condition for facilitating subsequent handling and storage. Besides such care, documents which might have been spoilt due to exposure to unfavourable climatic conditions and damage by insect pests also need attention.

Different methods of curative procedures are taken for different base elements of library materials. For a particular base element different curative measures are taken into consideration of the extent of deterioration and damage as well as the sources of damage, whether by flingi, mildew, mould or by insects. In the document is damage by insects, it is to be ascertained what kind of insect has caused this damage because various types of damage require different types of chemicals and curative measures for iradication and cure.

The edges of paper which might show crumpling tendency should be flattened. Use of moderately hot electric iron is satisfactory for the purpose. The portion to be flatterned should be made damp with a wet sponge, covered with blotting paper and ironed. If there are creases in the paper these should also be removed by ironing. If there are minor tears they should be repaid by passing stripes of good quality hand made paper at the back of the torn portion. If the portion where the tear exists is written on both sides it could be mended by pasting strips of their tissue paper on both sides of the tear. Torn and damaged covers could also be mended likewise, or replaced with need covers. In most of the papers the damage is usually confined to the edges of sheets. Such damaged portions may also be reinforced by pasting slips of all rag hand-made paper, care being taken that if there is writing on the back, the same is not covered in the mending process.

While selecting adhesives for repair work use of gum or glue should always be avoided. Both the above matrials swell in water and shrink on drying. Binders paste prepared with maida to which some copper sulphate (2-3%) has been added is quite satisfactory for the purpose. Maida paste when kept for 2-3 days tends to develop fungus and often loses its adhesive properties and therefore, it is advisable to prepare fresh paste when mending is to be.done. If tissue paper is used for repair, dextrin or their starch paste should be used for maintaining legibility of writing.

12.2 Cleaning and Sterilisation

A document which has accumulated a lot of dust, has pencil marks or is otherwise soiled, spotted or stained, and is folded, requires clearing, washing and flaltering. When the nature of infestation and the extent of damage are determined, the documents should be cleared particularly the affected leaves with much care and caution. The basic method of clearning paper is by gentle dusting with brushes which thorugh time consuming is effective and does riot harm the document in any way. Clearing can be done manually either with cotton swab or with soft brush. The clearning process may be accelerated by the use of an ordinary household vaccum cleaner with brush attachment which is effective in removing dust from ducuments. If, however the number of documents in need of clearning is larger, the use of compressed air rapidly gives good results. A blow of gun fitted with a pressure control direct a blast of air along the sides and edges of the volumes or bundles of documents in such a way that all free dust is blown off without damaging them. The. full pressure of the air is never directed straight at the documents themselvse. With controlled blast even brittle documents may be effectively cleared. Other methods of clearing involve the use of a soft rubber eraser, alcohal and benzene.

If the document is affected much by fungus attack, a cotton swab soaked in 5% solution of thymol in methanol of 5% solution of ortho-phenyi-phenol is rectified spirit can be used for clearinng after attack 1% pentachlorophenol in rectified spirit can be used for clearing. These methods are also the methods for stirilisation. Other low toxic insecticides may also be used for sterilisation depending on the nature of damage and the cause of such damage.

Salicylanilide, copper oxinate, formaldehyde, paranitrophenol, ethylene oxide and the like can be used for strilisation. Saltcylanidide is colourless, odourless, non-volatile and long fating. It can be used for brown stain and foxing, Copper oxinate is also very effective and is available in water and oil solutions. Formation in 40% formaldehyde is effective in strilisation of paper documents. If paper is badly damaged by fungi or mildew cover strerilisation by formalin can be done. Formalin is heated on a shallow plate over a 25 watt light bulb within a covered box. The document is exposed to the fume for at least 12 hours and the sterilisation can be done by inter-leaving. Sheets of tissue paper or blotting paper are socked with 10% Thymol is alcohol and these are inserted withn the leaves of the documens infested by biological enemies. These treated sheets may be inserted after every 8-10 leaves of documents. These should be kept for a few weeks.

12.3 Removal of Stains

There might be various types of stains on the documents suface. The brown spots, foxing, particles of mildew of fungus coating, insect excruta etc. can caue stains. Washing followed by sizing often suffices to remove stains and impart body to an otherwise brittle paper. The particular solvent to be used for paper stains depends on the nature of foreign matter. At the initial stage water soaked white blotting paper or cotton swab can be used. Organic solvents, which are perfectly safe, must frequently be used to remove more tenacious stains. With these solvents, it is not necessary to treat the entire documents as their application, unlike,that.of water, does not result in appreciable expansion of the paper It is safe to treat only those parts which require clearing with a non-linting cotton swab dipped in selected solvent.

The different solvents used for removing stains do, however, effect printing and coloured inks, causing them to run and leave new and unexpected stains on paper. It is therfore advisable to test the fastness of the ink to the solvent chosen. The selecton of a suitable solvent for the removal of stains is essential for successful clearing. Stains of oil, paint and adhesive tapes are safely removed in bonzene and carbon tetrachloride, or in a mixture of these solvent. Lacquer stains may be removed by treatment with acetone, while those of sellotape and wax are removed by treatment with a mixture of benzene and toluene and stains caused by shellac and mildew respond to treatment with alcohol. Other widely used solvents to remove stains are petrol, xylene, turpentine, pyridine and such type of materials. The solvent can be applied repeatedly and the swab is changed when found dirty. When the swab will be found clear after application it will be presumed that the surface is clearn. But for particular stain the correct must be used. The following table shows the stains and corresponding solvents :

Stain	Solvent
Glue and Paste	Warm Water
Adhesive tapes	Benzene, Carbon tetrachloride
Lacquer	Acetone
Oil, Greese, Tar	Petrol, Benzene, Pyridine, Carbon Tetrachllorise
Tea and Coffee	Potassium perborate
Mud	Water, Ammonia
Rust Stains	3%-5% oxalic acid
Ink Stains	Citric acid and oxalic acid
Mildew	Ethyl alcohol, Benzene
Wax	Petrol, Carbon disulphide
Shellac, Iodine	Ethyl alcohol
Varnish	Alcohol, Acetone, Pyridine
Paint	Pyridine, followed by water, Turpentine

Several other stain removers can also be used for library materials. Sodium hypocholoride solution of l%-2% can remove most of the stains one paper, but it should*be used with much-care because it can affect the cellulose fibres of paper The sodium chlorite process is the most safe for paper.

12.4 Other Stains

The stains encountered on old documents are after due to 'foxing' or to ink. Foxing is caused by mildew. It is difficult to remove by solvent treatment, it may be effectively removed by bleaching. But bleaching is somewhat orastic. It tends to weaken the paper and fade the writing on the document, although Carbonaceous inks are not affected. Hydrogen perodixe (H_2O_2) is a mild bleaching agent and should be tested on the stain before anyother. Ohloramine-T is generally used in the form of a 2 percent solution by dissolving 113.5 gms of powder is 5.6 litres of water. The solution is painted on the surface to be belached with a fine flat brush. Sodium hypochlorite, also known as chloririate soda is more convenient for belaching, Bleaching with Potassium permanganate involves the use of two baths, one of Potasium permanganate to oxidise the stain and the other to reduce the oxidised product to colourless or soluble subestarics, which are then washed out with water. Paper disfigured by ink stains must be considered separately. Chemical stains can be removed by oxygen and chloride bleaches acetic acid, ammonia, oxalic acid and sodium this sulphite.

12.5 Fumigation

Fumigation of documents is the effective method for destruction of all biological enemies. These are various types of fumigation. All the fumigants and fumigation methods are not effective for all types of fungie and insects. The particular fumigant and method should be applied in appropriate cases. The concentration of fumigants and the period of fumigation will depend on the condition of the document and the extent of infestation of the document.

Fumigation is gaseons treatment of materials to destroy micro-organisms and infestation by insects. These process involve two factors-an airtight closed compartment-so that the fumes\are kept inside the compartment to make them most effective and the properly selected fumigating chemical to destroy the particular damaging agent. There are two method offunigation :

1. Fumigation in airtight chamber of wooden OF steel cabinet of sealed type. This is an ordinary fumigation method and any library can afford it with a small or larger cabinet. This

is rather inexpensive, even a box can serve the purpose. The problerftis that this method can sterilise the documents completely in respect of adult biological agents. But in case of insect the eggs and larvae may not be destroyed completely. So there is the possibility of insect damage after a certain period which the documents ire shelved again.

2. Vacuum fumigation in a vocukm chamber with the use of fumigants. This method works in two ways The fumigation destroys the adult insects and the vacuum method % which the air inside is sucked mechanically, destroys the eggs and larvae,of the insects; Vacuum fumigation destroys the insects completely and prevents the possibility of further insect attack. This is a full-proof method. But this method is. very expensive. It requires the vacuum fumigation chamber which is a machine to be installed: Expert chemist and trained operator are required': Only a large library with sufficient fund and well-equipped laboratory" can afford this method.

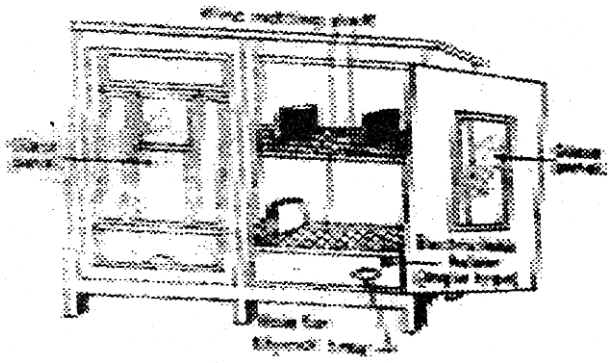
Fumigation is airlight chamber is generally used in libraries. The major fumigating agerits used are theymol. Formaldehyde, Paradichlorobenzene, Carbon disulphide, Ethylene oxide, Methyl bromide, Carbon tetrachloride, Ethylene Chloride, Carbon dioxide, methyl formate, Hydrocyanic acid gas, Ethylene dichloride with carbon tetrachloride in a ratio of 3 : 1 which is usually known as killopetra and Ethylene oxide with carbon dioxide-Carboxide *in* a ratio of 1 : 9 in case of vacuum fumigation.

Some widely used tumigation processes are given below :

12.5.1 Thymol Fumigation

Mould spores present in infested records are killed by exposure to thymol .furnes. Thymol fumigatio is particularly used for fungi, mildow arid mould eradication. Thymol does not give permanent protection but is effective and easy to use; although caution should be exercise as it effects ink and attacks paint and varnish. It does not reduce meldew stains but inhibits mildew growth effectively. Since it is a general purp fumigation it can be used for insect infestation also Thymol is low toxicity fumigant.

A suitable apparatus for thymol fumigation can be made by adapting an air-tight cupboard or box. The volumes to be fumigated are supported some 15 cm. from the bottom of the cupboard n a framework of wire net. A 40-60 watt electric lamp, is installed at the base of the cupboard are opend in an inverted 'V' form with the stitched or bound part forming the apex. A.wooden cabinet may also be made of the size of approximately 150 cm. by 75 c.m. by 135 cm. as the length, width, and height respectively. The interior of the cabinet should be left unpainted and unvarished. Thymol fumigation chamber is show below :



Thymol Fumigation Chamber

Soft rubber gaskets should be used at door to make it air-tighf A removable framework of wirenetting is to be placed 15-50 cm. above the bottom of the cabinet. A 40 watt electric bulb is fitted at the bottom of the cabinet. A watch glass is placed on the bulb. Thymol crystals are kept on the glass pot, book and other documents are placed on the wirenet in crystals (inverted V) position. When the electric bulb in lighted the heat generated will vaporise the thymol crystals in glass container The heating for one hour per day will be sufficient to vaporise thymol crystals. The thymol fumes will saturate the air inside the cabinet and will fumigate the books or other documents placed on the wirenet above the thymol crystails. The proportionate quality of thymol crystals is 120 grammes for every cubic meter of space inside the cabinet. The quantity of thymol crystals may be reduced if the documents are less infested.

The duration of fumigation depends on the condition of infested documents. A concentration of 100-150 gms. percubic meter is often suffcient and the time of fumigation varies from six to ten days, the heating of thymol being necessary for two to four hours every day. Documents infested with mildew should be first cleared and then famigrated. Documents of same infested condition should be fumigated together. In this way all the affected books and documents can be fumigated with the priority of most infested books earlier. In the documents are treated properly by thymol fumigation the danger of further attack by fungi mould and mildend can be reduced to a considerable extent.

12.5.2 Fumigation with Formaldehyde

Formaldehyde fumigation is very effective for insect infested documents. Fumigation is carried out in a chamber of size approximately 1.20 meter by 0.40 meter by 1,10 meter, so that a three tier book trolley may be put into it. If a smaller cabinet is made, the inside space can be divided by wire net tiers to accommodate books as in shelves The books should be kept half-open with their pages spread to ensure that the vapours penetrate between the leaves. Formation or 40% formal dehyde solution prepared with commercial formaldehyde solution and proportionate water can be used for fumigation. The temperature

inside the chamber is maintained at 30°C. This is done by using a Bunsen burner or a spirit lamp lighted under the pot with formal dehyde solution at intervals. The fumes then encirde the whole interior and fumigation is done. The documents are treated in this way for 24:to 48 hours according to the intensity of damage, After a few days they are checked to verity that fumigation has been effective.

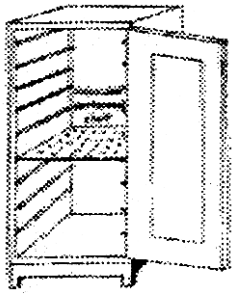
12.5.3 Fumigation with Ethylene Dichloride and Carbon Tetra Choloride

Vocuum rumigatiori is an ideal method for disinfecting documents from the point of view of speed, cost and thoroughness of the treatment, although fumigation may be carrid-out in airtight chambers if the bulk is small and vacuum fumigation facilities unavailable. The furriigant used is a mixture of three parts of ethylene dichloride and one part of is sufficient for a chamber of $2m^3$ capacity (1m x 1m x 2m). Documents are exposed for a period of twenty four hours, during which it is necessary to maintain a temperature of 23-85°C fumigation must be repeated.

12.5.4 Fumigation with Para-dichlorobenzene

A simple method of fumigation may be used in the library fo all types of matrials of any number depending on the size of the cabinet. A wooden box with sealed door can be constructed or a steel almirah can be used for this purpose. Books should be kept open the shelves of the cabinet or almirah. The shelve should be made of wire net or incase of steel almirah the shelves should be perforated. Paradichlorobenzene crystals are put on glass pots or saucer inside the cabinet or steel almirah. Then the cabinet or almirah is kept sealed for two weeks and can be reopened. In ease of steel almirah the sealing can be done by using flour in this method of fumigaton. Paradichlorobenzene evaporates in the air while it is, kept open. One kilogram of paradichlorbenzene in required for every cubic meter of air be kept either at the bottom shelf or on each shelf for fumigation of documents kept on the upper shelf

But this fumigation is not sufficeint to eliminate all the insects completely. Paradichlorobenzene kills insects and their larval, but not the eggs. Documents, after treatment should be kept under observation.

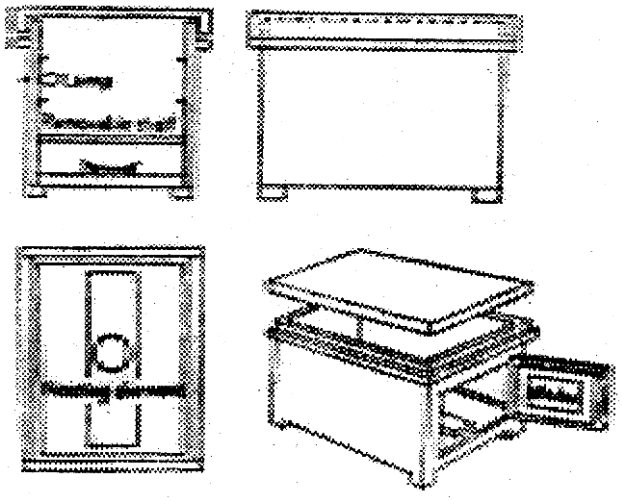


Steel Fumigation Chamhers

If it is found that the insects reappear, the same fumigation should be repeated. The advantages of this method of fiimigatin are that the method is simple, no special equipment is needed and number of books of documents can be fumigated. Even small libraries and personal libraries can adopt this method without much investment and hazards. The only thing required is a sealed box or an used almirah with perforated shelves :

12.5.5 Fumigation with Kilioptera

Fumigation can be done with killoptera, a mixture of ethylene dichloride and carbon tetrachloride for insect infested documents. A cabinet in required as in paradichlorobenzene fumigation. But in this method the liquid chemical is used at the rate of 225 ml. percubric metre of inside space. The concentrated liquid vaporises at normal temperature. So heat source is not required. Books or documents are kept open sperading over the perforated shalves, killoptera fumes are heavier then air. The chemical should be placed on the upper most shelf of the cabinet. Documents should be fumigated for seven to eight days depending on the condition of infestes documents. The adult beetles and larvae can be destroyed by this method but the eggs laid down in remote corners of the documents are not affected.



The fumigatin method should be repeated for the same documents after three or four weeks when the eggs will be nautre. A repection of the fumigation process for complete elimination of these species in usually necessary after this period.

12.5.6 Fumigation with Ethylene and Carbon

If the documents are infested by insects very badly, fumigation can be done with

ethylene and carbon. This can be used in a small way in any library. An air-tight cabient or almirah is required for this purpose. Books and documents are as usual kept over the perforated shelves. The ratio of the mixture as effective fumigant is three parts of etheylene dichloride with one part of carbon tetrachloride by volume. For a cabient of 1 metre by 1 metre by 2 metres, half a litre a liquid chemical is required. The inside temperature should be above 24°C. Documents should be fumigated for more than 24 hours. If the inside temperature comes down longer period of fumigation or repetition of fumigation should be done.

12.5.7 Vacuum Fumigation

All methods discussed so far are not completely full-proof. Only the vacuum fumigation is the complete method which can eradicate and destroy all types of insects in any living form. A Vacoum fumigation consists of a steel chamber of $10m^3$ capacity and an accumulator, where a mixture of gas ethylene oxide and carbon dioxide used for sterilisation is stored. In fact, vaccum fumigation requires a plant consisting of a steel chamber of desired size fitted with tube and controlled valves both for supply of lethal chemicals inside the chamber and equipment for making the chamber completely vacuum.

The chamber consists of a several wire net shelves at various tiers. Books and documents to be sterilized are placed in the chamber in their containers.either on trolley or platform. The steed door of the chamber is closed and the air inside expelled. Approximately 4.5 kg of ethoxide gas (a mixture of 10 per cent ethylene oxide and 90 per cent carbon dioxide by wight) are then introduced into the chamber. This mixture has been found to be effective against insects without causing harm to lirary materials. The infested documents are kept in this atmosphere for thee hours, during which the gas in once circulated in the chamber by means of electric pumps. After three hours, all stages of insect life-eggs, larvae and adults have been destroyed. The gas is pumped out and the vacuum broken by advertising air into the chamber. The door is opened and the documents are removed. Documents so treated may be safely stored in the stack rooms without any fear on insect damage provided the area itself is free from insects. The gas used is neither inflammable nor harmful to humanlife. This is the perfect fumigation method bent the problem is that the plant is very expensive and not available commercially.

12.5.8 Other Fumigants

There are several other fumtgants besides those noted earlier. All these’fumigants are used in air-tight cabinets in various proportions, concentrations and mixture. The iibraiarian may sdect and use the particular, fumigant available for his purpose. All of them can destry insects and larvae but not the eggs. Therefore, after fumigation process documents should be kept in isolation for at least three weeks to examine that there is no trace of insects. If they exist fumigation process should be repeated.

12.6 Precautions in Using Fumigations and Other Chemicals

All the chemical used as fungicide and insecticide as well as for sterilisation of documents, library stack rooms and shelves become more and more poisonous and harmful to human health. Therefore, these chemical should be used and handled with extreme care and caution, knowing fully the nature and residual efl ct of each of the chemical. These should also be used in right concentration and proper ratio of mixture in required conditions. The poisoning is possible at the time of applicatin or by subsequent contact with chemical residues. In some chemcals toxicity is greater, in some it is lesser. Sometimes high concentration and mixture of chemicals can cause high toxicity. All these jobs should be done by specially trained personnel under strict supervision of knowledgeable person.

The person responsible for using the chemical and application of fungicides and insecticides should know the risks associated with the work. They should also now the remedial measures if affected in any way The residues for the fijmigants can persits for several days in a room after fumigation. Adequate precautions should be taken. Several precautionary measures are noted below.

All the instructions and directions should be read and followed whatever printed on the container of the chemicals. Insecticides should not be transferred to unlabled containers and mixture of the chemicals should not be done outside the room in open space. Smoking should be strictly prohibited when handling these. Protective respiration should be undertaken while using the insecticides. Chemical like diclдren, diazinon chlordane, lindance, melattion should not be used room should not be used for atleast 24 hours after the completion of the trestment. Hands and face must be washed with soap and water throughly after handing or application of all kinds of fumigants and insecticides.

12.7 Deacidification

The major cause of deteroranon in paper is acidity, caused both by the materials used in he production and by atmospheric contamination. The deterioration occurs as a result of lydrolytic action on cellulose the main ingredient of paper and is measured in terms of the lydrogen-ion concentration in the water extract of a sample of the affected paper. The lower the pH, the greater is the deterioration in paper. Deaciadification of papers in known to reduce he rate of deterioration.

Extensive investigation into the causes of deterioration also confirmed that nearly all the deteriorated papers were highly acidic. Even if the ideal storage conditions, viz, temperature 22-25°C and relative humidity 45-55 percent are maintained in the stock room, gradual veakehing due to inherent acidity goes on. The acidity in paper is attributed partly due to absorption from the environmental atmosphere and migration from the acidic

material in contact. Treatment to counter residual acidity in paper prior to repair is thus desirable.

Rehabilitation of books and documents is required when these are affected by any reason and the deterioration or damage is caused by the biological, chemical or physical factors as well as caused by combination of these factors. Except in extreme cases, the rehabilitation of documents affected by physical factors is done by good housekeeping and taking proper care. In case of biological deterioratin and damage fumigation and sterilisation process are adopted for rehabilitation. For the chemical deterioration, whether intrinsic or external or both, deacidification of paper is done for rehabilitation of documents. Before making any repair job, strengthening the documents or restoration work, the paper of the documents should be deacidified

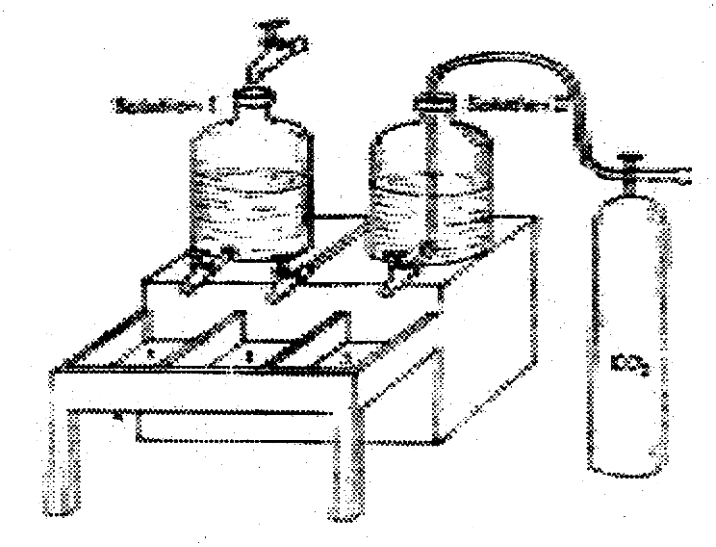
As noted earlier, acidity of paper is measured by pH mater and pH is defined as the concentration of hydrogen and hydroxilation. pH is inversaly proportional to acidity. Paper is considered neutral at 6.7 to 6.9 pH and if pH is lower than 4 pH the paper embrittles. The acidity of paper can be tested easily. A water seaked blue litmus paper may be held in contact with a paper for acidity test. If the blue litmus paper turns brown the acidity is proved and if the colour of litmus paper does not change or change a little, the acidity in paper is less. There is a number of methods for deacidification usal all over the world for various purposes some deacidification treatment are described below.

12.7.1 The use of two solutions

Calcium hydroxide and Calcium bicarbonate

This process consists of the treatment of paper with solution of calcium hydroxie and calcium bicarbonate. The acidyt of paper is effectively centralized by this process. It has an additional advantage also. During the deacidification treatment a small amount of calcium carbonate is precipitated in the paper so processed. It has an inhibiting effect on compounds causing degradation of cellulose and it also counteracts the absorption of acidety during storage.

The deacidification process involves treatments of document for twenty minutes each in two solutions. The first solution which consists of 0.15 percent calcium hydroxixde, neutralises the acid present in the paper, while the second solution of 0.15 percent calcium bicarbonate converto the excess calcium hydroxide to calcium carbonate, which is deposited on the paper under treatment as a fine precipitated. This precipitated calcium carbonate acts as a buffer against acid attack and protects the document against further deterioration.



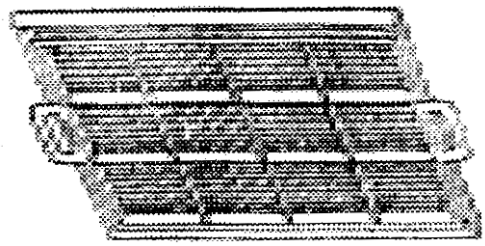
Deacidification with calcium hydroxide and calcium bicarbonate

Calcium Hydroxide

The solution is prepared by the following method. About 500 grammes of high-grade calcium oxide are placed in an enamelled container or glass bottle and 2-3 litres of water are added. The water reacts with the calcium oxide and and lusing the reaction considerable heat is released. Afort about the minutes the solution is stirred and poured into a bottle of 23 litre capacity. The bottle is them filled with water, stirred with a wooden or glass rod, and set aside to allow the particles to settle. When the solution becomes clear, it is strained off and discarded. The bottle is refilled with water, strirred and set aside again until the particulers have settled. This liquid solution contains approximately p. 15 percent calcium hydroxide. It is decanted and used for deacidification purpose The bottle may be refiled three times, the contents stitted and the resultant clear solution used for deacidification without affecting the efficiency of the process in any way.

Calcium Bicarbonate

The second solution, calcium bicarbonate solution is prepared by taking about 500 grammes of finely powdered calcium bicarbonate in a 25-30 litres poracetaion or enamelled container minutes. When the carbon dioxide gas is passing through, the solutioin is kept well stirred and bubbles will be found in the container. The resultant calcium bicarbonate solution in milky and of approximately 0.15 per cent strength. Unlike the first solution, it must be prepared afresh each time the bottle is emplied. while the two solutions are prepared, three enamelled trays or sinks are-to be kept side by side. The size of the trays



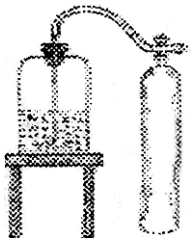
Tray for deacidification

must be much larger than the documents, since the documents should be immersed completely in three trays. For deacidificataion each paper sheet is placed on, a waxed paper of larger size or on a stainless steel wire frame of appropirate size and both are immersed fully in the tray containing calcium hydroxide solution. Depending on the depth of tray (2.5 cm to 6 cm) 5 to 10 sheets can be treated at a time. Sheets are removed after 20 minute and the solution is drained off. Sheets are immersed in fresh water for few minutes and then immersed in Calcium bicarbonate solution for 20 minutes. These are again removed solution for 20 minutes. There are agiain removed and placed in fresh water to remove excess calcium bicarbonate. During the ends of the trays. The treated papers are finally pressed in.between blotting papers for sacking the water and kept on the racks of wire rest for drying. Much care should be taken so that paper sheets are not affected plysically.

12.7.2 The use of Single Solution

Magnesium bicarbonate :

Forty grammes of magnesium carbonate are placed in a 23 litre glass container which is then filled with water. Carbone dioxide gas under pressure is bubbled through the solution until its colour changes from milky to clear white. Magnesium carbonate is slightly soluble in water. Under the action of carbon dioxide it is converted into magnesium bicarbonate, which is soluble in water. The clear soluiton of magnesium bicarbonate these prepared may be used immediately, deacidification with a single solutioin is an effective method of stabilizing paper.



Magnesing bicarbonate solution for deacidification

12.7.3 Deacidification by Spraying

In this process the solution of magnesium bicarbonate is used. The solution is prepared by dissolving 25 grammes of magnesium bicarbonate in about 1 litre of water and by passing carbon dioxide gas through the solution for two hours under pressure. This process is very effective for bound books, maps, etc. which cannot be immersed in trays. The spray gun type equipment as used for spray painting is used for this purpose. The pages of the book are kept open and spraying in done over the pages of the book so that the pages become damp and slightly wet. The treated book or document is covered with aluminium foil or such type of wrapper to prevent evaporation and kept overnight so that the solution is evenly soaked in the pages. The alkaline compund migrates throughout the fibres of paper and thus obtains a good degree of effectiveness. This is a good method of deacidification of book is not divided into pieces. Print the proper care should be taken to ensure that all the pages of a book are properly soacked in.

12.7.4 Lime Water

The most inexpensive process of deacidification is the treatment with lime water. A solution of carbon hydroxide prepared with calcium oxide or lime with water. While the unsoluble panicles are settled at the bottom, the solution is kept on a tray. The sheets of paper are immersed into the solution and kept for 20-30 minutes Then these are drived after soaking with blotting paper. This process can be used when the paper is slightly acidic. The deacidificution effect lasts for a long time.

12.7.5 Non-Aqueous Deacidification

Wet deacidification has certain disadvantages. The bound volume is to be unbound to reduce the pages in sheets of paper. .Then after the treatment these are to be rebound which is expensive. There is also a possibility of missing pages.

This is a time consuming affair. It is better to deacidify the books in bound volumes. Dry method is a good process of deacidification. This is less expensive also. Non-aqueous deacidification processes can be used for bound volumes of books. This is inexpensive in the sense that there is no expense for opening the binding and rebinding. At the same time more volumes can be deacidified in a short time.

The treatments of non-aqueous deacidification are done with non-aqueous solution containing a deacidification agent and an organic solvent. The organic solvents are available commercially over a wide range and these are bladed to obtain the desired requirements and properties. These solvents evaporate quickly at room temperature, so there is no problem of drying. But these organic solvents arc either inflammable or toxic. Precaution should be taken at the time of handling and application.

Barium hydroxide can be used for deacidification. Barium hydroxide solution is prepaid by dissolving 1.86 grammes of bearium hydroxide octahydrate in 100 ml. of methyl alcohol. The solution can be applied by brushing or by spraying. Documents should be kept open for sometime for drying in room temperature. The solution is both toxic and inflammable.

Magnesium acetate is effective'for deacidification. It also improves the durability of paper. The solution is prepared with methylated spirit. Magnesium acetate be soaked in the solution by burshing, spraying or immersing in the solution.

Magnesium methoxide is available commercially as a 5 percent by wight solution in methyl alcohol or it can be prepared in laboratory. Sheets of paper may be immersed into the solution and stirred until these are soaked with the solution. Then these can be removed and kept for drying. It increases the pH strength. But the soaking process should not be more than a few seconds.

According to the suitability, requirements and convenience any of these deacidification methods can be adopted in the library.

12.7.6 Dry Method : Ammonia

Ammonia gas is cheap, safe and easy to use. It is suitable for deacidifying documents written in water-soluble inks and also those containing dyes and colours.

Documents and books requiring deacidification one exposed to dilute ammonia (1 : 10) in a sealed chamber. It has been observed that the ammonia vapour contract the acidity in the papers after a period of exposure varying from twenty four to thirty six hours, This treatment does not affect both the durability of the paper and the water-soluble inks. This process raises the pH value between 6.8 and 7.1. This process can be used for bound volumes also. It is a dry method of deacidification.

Cyclohexylamine carbonate is also used for deacidification. The other deacidification processes are still in the darlopmental stage. The most promising appears to be that which involves the use of magnesium methoxide in a nonaqueous solvent. Besides deacidifying documents, the alkaline treatment has one additional advantages. All the slips and other minor repairs that might have been done can easily be removed from over the document in an alkaline bath, the residual paste, etc.

12.8 Summary

This unit has discussed certain curative procedures to restore the longevity of the documents. This unit has acquainted you with various types of damage and the corresponding chemicals to be used for curative measures. Some widely used fumigation processes have been described; Deacidification process by various ways have also been discussed.

12.9 Exercise

1. Describe various methods of cleaning documents to remove undesirable elements.
2. How foxing is caused? How would you remove it?
3. What is fumigation? Discuss the full proof method of fumigation.
4. What precaution would you take in using fumigants?"
5. What do you understand by'house keeping'? How would you achieve it?

12.10 Keywords

1. Deacidification : A process that neutralises the acidic components in paper and usually provides an alkaline buffer to counteract acidic buildup in the future. It is the treatment to the paper or othef library materials to neutralise acidity in order to improve durability.

2. Durability : The degree to which a paper retains its original qualities and strength under continual'usage.

3. Fumigation : Gaseous treatment of materials to destroy micro-organisms and infestation by insect. Killing or deactivating mould or insects by exposure to poisonous fumes or vapour, usually done in a vacuum air tight chamber,

4. Mildew : A thin, whitish, furry coating or discolouration produced by fungi on organic material stored in a damp climate.

5. pH value : Potential of Hydrogen. The numerical expression used by chemists to describe Hydrogen concentration. A measurement or numerical expression that tells if paper is acidic or alkaline. Seven is rentral; each point is tenfold, increase. Material below seven is acidic; above it is alkaline.

12.11 References and Further Readings

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Unit 13 ❑ Repair and Restoration

STRUCTURE

13.0 Objectives

Most of the countries have a huge amount of library materials which need to be preserved and conserved for the use of ruture generation. The deteriorated and damaged documents which have become unusable or connot be handled, should be repaired to make

them usable physically. After reading this unit you will be to

1. know why repair and restoration work should be done
2. plan the steps required for repair
3. get a clear idea about the techniques of repair and restoration of book materials.

13.1 Introduction

Life and durability of books and documents depend very much on the chemical composition of constituents for example, paper, ink or protective covering materials. Documents which one deteriorated, damaged, worm-eaten, unintelligible owing to holes in them, torn, disintegrated or in any way effected physically very much, should be repaired individually according to the condition of damage and there should be strengthened. Preventive conservation which includes neutralising acidity imparts stability to documents. Repairing jobs must be done with utmost care, patience, and efficiency in consideration of physical condition of each item.

The general principles, as mentioned below, should be adhered to for making the document durable and usable physically for a longer time.

1. Pages of a -document should be repaired identical to the original pages as far as practicable.

2. Repairing and mending must be clean and efficient

3. If a portion of a page is totally damaged, that portion should be repaired with same kind of paper

4. Whatever the method of repairing or mendings the leaves of a document should be subject to remending without causing any damage to them if required in future, the process should be revesible.

5. A method, which is paper and inexpensive, should be followed

6. The equipment and materials used for repairing and mending should not be harmful in any way to books and documents.

7. Repairing and mending should be durable and should last for a long time S. The nature and extent of the repair should be evident.

9. The reading matter or illustration must not be defaced in any way.

10. Maximum reinforcement should be done at a minimum cost. Repairing and mending are to be done for the badly damaged documents. The nature of repairing, the extent of repairing and materials to be used for reapairing as will as techniques to be followed will depend on the nature of document and extent of damage. There may be instances where mild to heavy damage is caused along with deterioration of paper, binding or other materials affected by more than one physical, chemical and biological enemies. If the paper is broken, torn or with worm-eaten holes but the paper is strong othewise, repairing or mending makes the book usabte. Only repairing or mending can be done for less valuable books or books which will be weeded out after some time.

When books of doucments are damaged and deteriorated badly by the above-mentioned enemies, condition or paper is week and very brittle, cellulose Sbies of paper are disintegrated or degenerated for acid reaction, discoloured for any reason, stained by obnoxious elements, the condition is deteriorated and the documents or books are valuable and rare. Just repairing is out suitable for such documents. Paper restoration work is tc be done in those cases.

13.2 Minor Repair

Minor repairs are effected on documents which are only slightly damaged or torn. An adhesive in the form of a synthetic (Polyvinyt acetate) paste, a solution of cellulose acetate film in acetone, or flour paste is applied to the damaged or torn portion and tissue papeijs laid over the tear and pressed down. The process is repeated on the other side of the document. When the paste dries, the excess tissue paper scraped off. Alternatively, strips of tissue paper impregnated with polyvinyl acetate may be employed.

Minor repairs are suitable for strengthening one portion or mending a single tear in a document. But such repairs in a number of places in the same document will look like patches, which affect the life of the paper and at the same time patches lend an ugly look to the repaired sheet. Moreover, in the case of old documents, the paper is strengthened wherever minor repairs have been made, while the rest of the paper remains weak. This often leads to breaking at the points where weak and strengthened portions meet. Minor repairs in any case, should be limited to a minimum.

13.3 Sizing

Sizing imparts the necessary strength for safe handling; Sizing is the final step in the process of restoration and is carried out on documents which require stengthening but nto restoration. Before sizing tests must be made to ensure that ink does not run. Writing which is soluble in water should be protected by the application of either polyvinyl alcohol emulsion or solution of cellulose acetate film in acetone. Documents with coloured writings should be sized separately.

A number of synthetic compounds are used as sizes. These include the following :

Methyl cellulose (trade name Glutofix)

Soluble nylon (trade name Calaton)

13.4 Techniques of Repair and Restoration

Repairing and restoration work consists of a series of jobs depending on the nature a.id extent of damage. It includes cleaning, sterilisation, reinforcing, restoration of readability

and such other jobs by which, last for a longer period, if not permanently. Repairing or mending is done for individual units as and when required. But restoration is done for the whole book or document to restor it to the original condition as far as possible and to make it fit and suitable physically and to preserve it permanently. Restoration work comprises all the jobs of sterilisation, deacidification, repairing, lamination and such other jobs required to restore the document as a whole. Repairing jobs involve cleaning, strengthening, mending as and when necessary. If necessary, repairing jobs maybe done before restoration.

Restoration and repairing jobs are performed in various stages one efter another as needed. Repair of documents does not mean merely strengthening them with paper and paste. The work requires a good deal of knowledge and training to understand the nature of documents, extent of-damage and various processes of repairing. The repairer and restorer must know the different methods of repairing, their respective merits and demerits. He must be aware of the constituents of the base materials, their composition and the causes of damage. Before repairing each document should be examined individually and thoroughly to ascertain the extent of damage or degradation. Then only a decision can be taken about the method of repair and restoration to be adopted.

Before starting the jobs of repair and restoration the restorer must examine the. following points :

a. Nature of the material
b. Extent of damage
c. Causes of damage
d. Factors of damage
e. Type of ink and readabilty
f. Acidity
g. Number of pages in serial order.

In repair and restoration a series of surgical operations are involved. Sometimes a portion of document is eliminated and new addition is made be better and stronger element for reco’nstitution of the original state or even stronger element for reconstruction of the original state or even stronger than that. Materials should be selected carefully if replacement is to be made,

Nature of the material indicates the basic element of the material such as paper, boar, the particular kind of paper, etc. It also points to the basic consitituent of paper pulp, nature of cellulose fibres, sizing and loading materials, sewing materials, adhesives should be examined. Extent of damage reveals the acidity in paper, whether soiled, discoloured, damaged by fungi, insect, moisture, chemical reaction or a combination of these. Paper may be brittle, sustable, weak in PH strength, insect-eaten. Documents should be examined to determine to what extent it has been damaged. Causes of damage are to be ascrtained, whether physical, chemical or biological enemies have done the damage. Factors of damage indicate the particular enemy whether fungi, mildew, mould, insect, water, fire, etc. and if insect what type of insect has caused the damage. Type of ink means the basic constituents

of ink, their chemical constituents which will not do any harm to the paper or other documents in any way. All the work should be carrid out with care and by trained technicians under supervision.

The process carried out should be reversible. All repairs should be carried out with processes which not only give strength to the document but which may also be reversed by the restorer if the original is required after some time for some reasons. A number of processes have withstood the test of time and they have been used with considerable success in the past. It is essential to apply a process of proven suitablity which may be easily reversed later or during restoration itself

The process applied should provide maximum reinforcement which provides maximum strength-both durability and permanence, and which at the some time economical and cost effective.

Materials used for repair should be durable and permanent. Adhesives, threads and other materials should be of best quality. The compatibility of materials is an important factor in durability. The tremendous advance in modern technology has led to the production of many synthetic fibres and materials claimed to be effective and without any harmful effect on paper. The restorer should use only those materials, whose behaviour has been tested over a long period of time.

13.6 Processes

Keeping in view the rules for repair and examining all concerned factors repair and restoration methods are determined for a particular document. Jobs leading to these processes are carried out in stages. Generally jobs are done through the following stages.

First stage is cleaning. The basic method of cleaning paper is by gently dusting with soft brushes and cotton swab. Although it is time consuming but this is effective and does not harm the documents in any way. The fungi, mildew and mould, leftover by insects, worn-eaten paper particles, dust and dirt, etc. should be dusted carefully. The folds and engles of binding, inside of spine places of sewing in-between folded pages, etc. should be cleaned.

Second stage is stain removal Surface dirt and superficial soiling, pencil an ringer marks may be removed by soft rubers or other non-abrasive erasers, such as, spange rubber, -art gum, soap, synthetic erasers of materials such as vinyl.

Kneaded erasers are perhaps the most gentle in their action, removing dust and pencil marks as easily as a blotter soaks in ink. If required, chemical solvents may be used in appropriate cases. A list of these solvents in given in the previous unit.

Third stage is washing. Washing in clean, preferably distilled water helps to remove dark, soluble matter and some free acid from the paper. It also minimises water stains and permits the removal of wrinkles and other distortions. An enamelled tray, large enough to accommodate the sheets of paper is filled to about half the capacity with distilled water.

Each sheet should be supported on plastic netting or waxed paper before immersion in the water. The handling should be done with great care so that sheets of paper may be immersed together and allowed to soak for thirty to sixty minutes. Then the sheets are to be dried carefully between clean sheets of blotting paper on a glass plate. If required, warm water can be used for better result.

Fourth stage is deacidification. There are various methods of deacidification, such as wet method, dry method, non-aqueous deacidification. Various kinds of chemical solutions are used for this purpose. Determining the particular condition of the documents deacidification can be done.

If the document is damaged by fungi, mildew, mould, various types of insects, the document should be sterilised. Which needed, documents should be fumigated. All the stages and all the procedures may not be required for all the documents. For the purpose of curative measures each document should be examined, decision should be taken for rehabilitation and jobs should be undertaken before repair and restoration work.

13.6.1 Pastes and Adhesives

In case of repairing or mending same type of base material as was used in the original document is used. By this way both the base materials can be integrated. With this base material a paste or adhesive is used for repairing. Different kinds of paste are used for this purpose. Availability, price, material, utility, harmlessness, durability and other related factors should be considered which choosing a paste.

Paste differs from glue in (a) having a greater moisture content and (b) drying more slowly. It does not stain the paper but, iike glue, attracts insects. Paste is used for mending and repair work, fixing end papers and for covering and fixing soft cloth such as silk, cambric, etc. It is not used for fixing book-binding cloth, as it softens cloth and removes its colour, size and grain. Paste is used for fixing bather to volumes which require binding, because it dries slowly and allow the binder more time to handle the whole process, while glue dries quickly and does not permit enough time to pull and form the leather into shape. Basic materials and preparation of some pastes generally used are given below:

Dextrine	**Paste**
Dextrine	2.5 kg
water	2 It
Oil of cloves	40gms
Saffrol	40 gms
Barium carbonate	80 gms

Water is boiled in large pot. When boiling, dextrine powder is slowly added to water. While adding the powder water should be constantly and vigourously stireed Otherwise nodules will be formed by dextrine. It will take about 30 to 40 minutes to mix up the powder. Then Barium carbonate should be added and stirring should continue. Finally oil of cloves and satfrol are added and will mixed for 6 to 10 minutes. The paste may be used on cooling. Obviousy the quantity of mixture will depend on the requirement of he library.

Starch or Moida	**Paste**
Maida(wheat flour)	250 gms
water	2ft
Copper sulphate	0.8 – 10 gms
Glycerine	5 gms.

Maida should be added to boiled water as described above like dexrtine paste. A solution of copper sulphate should be prepared with little water and is to be added after maida is mixed up. The paste will be build for sometime and will start frothing. At this time paste should be well-stirred so that there may not be any charring of starch at the bottom'because it presses to like that. At the last phase of cooking glycerine is mixed and stirred.

Then the paste is prepared and can be applied on cooling. While repairing is done by paper, starch paste is used. If the repairing is done by tissue paper or chiffon, dextrine paste is used.

13.6.2 CMC Paste

More dependable and long lasting paste is CMC paste. It stands for Carboxymethyl cellulose. Sodium salt of CMC has been proved to be an effective adhesive in very low concentration in water solution. The method of perparation is that a measured quantity of water is heated to 80°C- 90° c. Sodium salt of carboxymethyl cellulose is added in small quantity after heating it is discontinued, with constant stirring till a concentration of 2.5 to 3 percent (by wight) of techemical is obtained in the solution. The solution is kept for 3 to 4 hours to obtain a homogenerus dispersal of the chemical. The paste has good adhesive qualities, maintains better transparency in chiffon and tissue repair as compared to dextrine and starch paste. CMC paste has mildew resistance properties and is easy to apply with brush.

13.6.3 Glue

Glue is an organic substance prepared from hides and bones of animals such as cattle, sheep and horses. It has been used for book binding for centuries for attaching the spine, fixing cloth to the boards and in making spilit boards. Glue differs from paste in that it remains flexible at normal temperature on drying, whereas paste dries to a brittle consistency. Glue is of special value in the rounding and backing of volumes. After the initial set it permits rounding of the volume without causing damage to the spine. It penetrates between the various sections when hot and ensures a better mechanical hold. Glue is soaked in water before heating.

Liquid glues marketed for binding work usually contain additives such as cresol and acetic acid. These glues tend to affect the colour of certain papers and cloth, and their effect shoud therefore be tested before use.

13.6.4 Synthetic Adhesives

Among the many synthetic materials the thermoplastic structural adhesives are of most interest to resorationists and conservations. A thermoplastic is a resinous material which is

soluble in various nonaqueous liquids and which remains permanently fusible. A structural adhesive is one which solidifies on setting as distinguished from those which remain tacky (that a adhesive tapes)

Polyvinyl acetate in the form of an emulsion has been used in place of traditional glue for repairing. As an adhesive for the spine of the book it has emaikable adhesive properties and can be used cold. It is a good adhesive for silk, nylon and terylene, where glue and paste are nof very satisfactory. It is also less liable to attack by insects and mould growth. Polyvinyle acetate emulsion is marketed under various trade names. These products contain various additves which influence their ultimate use and care must therefore be exercised in choosing such a product for conservation work. Particular attention should be paid to the following features :

(a) The nature of the material added to stabilize the emulsion; (b) the PH of the emulsion; and (c) the possible presence of a thickening agent used to increase the viscosity of the emulsion. Any emulsion containing a thickening agent should be viewed with reserve by the conservator.

Polyvinyl acetate emulsion, unlike glue, is difficult to remove once it has set. This is a disadvatage from th Archiviot's point of view, as it hampers the removal of repairs from valuable documents. G.D.M. Cunha in *Conservation of Library Materials,* 1967 points out that "extravagant claims have been made by some manufactures of polyvinyl acetate (any other synthetic resius) regarding the alleged capability of these materials to make old books like new. These white emulsions, generously painted on worn-out books, are claimed to fasten separated covers, consolidate rotted leather and rejuvenate cloth. Large numbers of-fine volumes have been ruined by the improper use of these products. What must be remembered is that polyvinnyl acetate emulsious are good adhesives and nothing more when-used as one should use paste or glue, they make very strong bonds which can rarely be separated without damaging the fastened materials Since one of the basic principle of rare books and avchive restoration is that nothing shall be done in the restoration that cannot be undone if necessary, these irreversible adhesives should be avoided for all except genera! library work.

It is not known how the plastic adhesives will behave over the years The choice of synthetic adherives or conservation work should be limited to those which are soluble in water or solvents like alcohol, acetone and bengene. Such adhesives may be used with alone or in combination with traditional pastes and glues.

13.7 Lamination

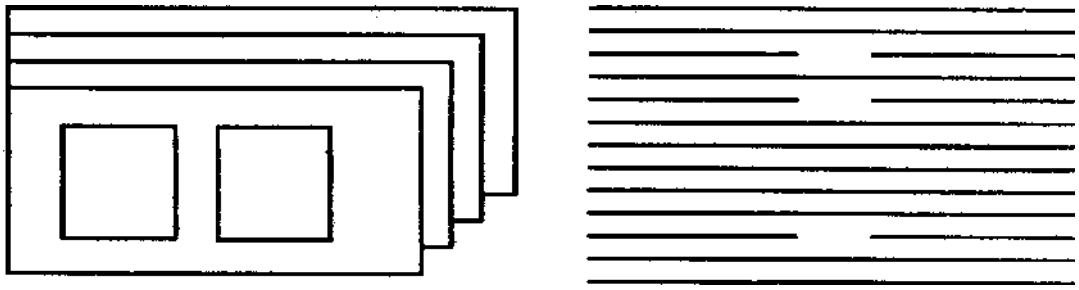
While the whole document is to be preserved, there are insect holes in the leaves of the document, paper is so unstable that the document or book cannot be physically handled, the book cannot be used without reinforcement, the document requires the final restoration technique, known as lamination. Before lamination the document must undergo all the processes of restoration that is, cleaning, washing, removal of stains, sterilisation and in particular deacidificalion. Lamination is the method of making a 'sandwich' or envelope a

sheet of paper in between two laminating agents, and thus they protect the sheet of paper from all external enemies as well as reinforce it to make it physically strong enough. Lamination is the fiilproof process of restoration if the document is properly treated and deacidified. Lamination work itslef is a distinct art of preservation. A well-equipped laboratory or workroom is required for lamination work

In lamination work the document or sheet of paper is kept in between two sheets of supporting materials by using some kind of adhesive. The sheet of paper is fully wrapped in airtight condition. It should be the last resort for restoration of documents of be kept permanently in congenial atmospheric condition. Such supporitng materials are used in lamination so that the intelligibility or readability of document is not hampered and the document is preserved safe and protected form any atmospheric contamination since it is fully covered on both the sides. There are various mathods and materials for lamination.

Lamination process involves hot-sealing a deacdified document with cellulose film and tissue paper in etiher a steam heated flat leed hydronlic press or on electrically heated roller press. A “sandwrich” or ‘envelope’ is preposed by assembling the materials in the following order; tissue paper, cellulose acetate film; the document; cellulose acetate film; and tissue paper.

The deacidified documents of the volume are placed in such a way that there is a gap of the volume are placed in such a way that there is a gap of 5 cm. in between the sheets, 1 and 8, 2 and 7, 3 and 6, and 4 and 5, respectively of a section The arrangement of sheets is step formation in the manner shown in the following figure



Thus from eight loose sheets, four pairs of sheets are found. These when placed one inside the other and on folding in the centre give what is known as section or signature This is recurred with the next group of eight sheets and so on til! all the sheets of volume have been enveloped. On lamination, their gap portion (laminated tissue) becomes strong enough to serve the purpose of “grand” for stitching the documents into covers.

During the preparation of a sandwich or envelope of paired documents, as noted above. all loose fragments and the edges of the documents should be carefully festened to the acetate film in their porper places with a cotton swals. Each sandwich or envelope is then put between two sheets of Taflon’ (tetrafluore thelene) before feding it into the press.

In case of hydranlic lamination the sandwich is covered with stainless-steel plates and a double thickness of blotters before being placed on the platen. For satisfactory lamination

notmore than two sandwiches or envelopes should be placed on each platen.

In our country the following materials are used for lamination. These are glassine paper, tissue paper, chiffon, and cellulose acetate foil with tessue paper.

13.7.1 Glassine Lamination

Glassine paper is transparent and looks almost like oil paper. The paper is tough and thin. It is the most inexpensive lamination materials. All kinds of lamination work require workroom with the equipment, tools and laminating materials. A large table is necessary for the job. At the centre of the table a thick sheet of glass sufficiently large to perform the job is to be placed close to he work.

Lamination work is done on the glass top. The document on the sheet of paper to be laminated is placed on the table. It is to be cleansed and deacidified beforehand. Paste is applied on the paper very gently with the help of soft bursh.. A sheet of glassine paper larger than the document is pressed gently but firmly over the document or sheet of paper with cloth piece or cotton swals so that no creases or air bubbles can be formed. A priece of alkathene sheet or tesylene cloth should be placed beneath the document. When one side of the document is pasted, the document is lifted with the help of the alkathene sheet. Then the other side of the document is pasted with glassine paper in the same way.

For drying both sides of the laminated sheet is kept for sometime. Then the edges of the glassine paper on three sides except the left hand are trimmed to the size of the documents. On the left hand side the edge is cut keeping the strip of glassine paper. In glassine lamination starch paste is used in most cases.

13.7.2 Tissue Lamination

Lamination with tissue paper is more durable. A particular kind of near-transparent and though tissue paper is available commercially for use in lamination purpose. This is an initation of Japanese tissue paper without sizing materials and free from oily and waxy constituents. The document is placed on alkathene sheet or terylene cloth over the glass top of the tissue lamination. Dextrine paste is applied on the document. A large tissue paper is laid over it gently to ovoid any crease or bubble. The tissue paper is gently pressed over the document with paste by a soft, cotton pad or cloth pad. The document is then turned over and pasting of tissue paper is done in the same way. When both sides of the document are pasted the wet laminated sheet is then lifted and spread over a plastic net frame for drying. Finally the laminated document is trimmed in the same way as is done in glassine paper lamination. Tissue lamination is effective for slightly weekened paper.

13.7.3 Chiffon Lamination

Chiffon is the fine transparent silk gauze. It is quite stronger than the other two lamination materials. It can be used for the document which is extrenely fragile, damaged or insect-eaten. All the holes and damaged portion of the document are to be carefully

repaired before undertaking repair with chiffon. On the alkathene sheet or terylene cloth over the glass top the document is placed. It is covered with chiffon piece or silk gauze. Dextrine or CMC paste is applied over the chiffon piece with a soft brush starting from the centre and spreading outwards. When the entire document is so covered and treated with paste, the assembly is turned over on another alkathene sheet or terylene cloth used. The first alkathene sheet which is now on the top is carefully removed so that the document remains intact on the second alkathene sheet. The process of pasting of chiffon piece is repeated on the top side.

After the chiffon has been fixed on both sides of the document, much care is to be taken to avoid creasing of the fabric. The sandwiched document is allowed to dry to some extent- Then the semi-drieal document enclosed in between tow alkathenes sheets or terylene cloth should be kept pressed in a hand press or between two pieces of plastic boards with wright over them, when the documents are properly pressed and dried up these should be removed from alkathene sheets and edges or the laminated document should be trimmed as described before. Starch pasted should not be used in chiffon lamination.

These processes of lamination are known as hand lamination on because they are done manually. Hand lamination has an important advantage. Each sheet is laminated manually. Therefore, the deteriorated condition of each sheet of paper can.be taken into account. Considered invidually and judging the condition of the sheet as an independent unit lamination can be done accordingly. The other advantages are thatfungus attack and insects connot do harm to documents since these are laminated and not exposed to such enemies as well as atmosperic contamination. Insecticides are applied to the paste, making it fungus- and insect proof. Documents are deacidified, so no acid reaction will be there. After lamination sheets of paper cannot be brittle and weakened and these become flexible. Another important advantage is that the sheets of paper can be delaminated, if required, re-laminated without causing harm to the document.

13.7.4 Callulose Acetate Foil Lamination

The best but most expensive lamination is done by celujose acetate foil. The invaluable collection of early printed books, rare books, manuscripts should be laminated by cellulose acetate foil in view of the priceless treasure. This kind of lamination makes the documents more or less permanent. Documents laminated by cellulose foil can withstand even normal rough use and can last indoubtedly. for centuries. Cellulose acetate foil is ractically used as a loading element or adhesive. Lamination is done by tissue papers. These materials are not available in India. It is to be imported from USA and original Japanese tissue paper is to be imported from Japan to get the best result.

The usual process of lamination is machine lamination. The document is sandwiched within two cellulose acetate sheets and over these are kept two sheets of tissue paper.

The document enveloped in this way is pressed either under a steamheated flat-bed hydranlic press or an electrically heated roller press.The tissue foil and document are assembled in the following order.

Tissue paper
Celluloseacetate foil
document
cellulose acetate foil
Tissue paper

The assemblly of such units of documents are put into the machine. By pressure and heat the foil is melted and tissue papers are pasted over the document on both sides uniformly. Thus a complete independent unit of laminated document is made.

Obviously it is a very expensive process of lamination in all respects. It requires costly machinery, the expensive imported'materials, the trained and experienced personnel with expertise, a complete lamination laboratory with all physical facilities and expensive equipment. A manual process of hand lamination using cellulose acetate foil was develpped at the National Archives, New Delhi. This is simple, inexpensive affair except the imported film and tissue paper. In this process of hand lamination heat and pressure are not required. Cellulose acetate foil is turned semiplastic by the use of acetone and on drying this forms a band between tissue paper an document, the document, that requires lamination, is placed on the glass top and a piece of cellulose acetate foil larger than the document in all sides, is placed over the document. A sheet of tissue paper slightly bigger than foil is spread gently over the cellulose acetate foil covering the document. A cotton swals dipped in acetone is gently rubbed over tissue paper. Usually acetone is applied to the centre of the surface of the unit and wiped towards edges. Small quantities of actone from the cotton swab penetrate the tissue paper and reach the cellulose acetate foil which becomes semi-plastic and on drying binds the tissue paper with the document

Care should be taken so that the cotton swab with acetone is only gently pressed, othewise great quantity of acetone will be released and can dissolve the actate foil completely at places, which may iook later like patches on tissue paper The unit is kept sometime for drying, and them lamination on one side is made The same process is done on the other side of the document by reversing its position. When both sides arc laminated and dried the document will be trimmed as described before. After lamination on both sides the document is prepared in a five-ply sandwich-tissue.paper. cellulose acetate foil, document, cellulose acetate foil and tissue paper, as is done in machine lamination.

13.8 Summary

In this unit we have discussed ihe steps required for repairing of library documents. The techneques of restoring and repairing have also been explained. Different lamination processes have been dealt with.

13.9 Exercise

1. How does paste differ from glue?
2. What are points to be checked before starting repairing and restoration jobs?
3. What is lamination? How would you do the lamination work?
4. Discuss the various processes of lamination.

13.10 Keywords

1. Cellulose acetate: A synthetic polymer compound used as base in the manufacturing of coatings and films. It is 'safety' film stock introduced around 1930; It does not burst into flame in normal environment but does shrink nd separate irom the emulsion. It is an unstable material

2. Glassine : A glozed, highly beaten semi transparent paper not easily penetrated by air, used to make envelopes and sleeves for storing photographs, stamps and other paper materials. Glassine papers are usually acidic and hygroscopic. Some are now produced that are alkaline.

3. Glue : An adhesive whose principal constituentis protein from animal sources.

4. Hand lamination : The process provides a coating of chiffon and fixing cellulose acetate foil to it by means of acetone.

5. Japanese tissue : A highly absorbent, strong ,quality paper made from plant fibres and used in the repair of paper conservation.

6. Tissue Paper : Fine (qualit paper deal for repair and restoration work. Any thin, light wright, nearly transparent paper, often tipped into cover the face of illustration to prevent offset of the ink of an engraved or catched illustration the text paper oppose it.

13.11 References and Father Reading

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Unit-14 ❑ Preservation of Degital Objects

STRUCTURE

14.0 Objectives

After reading this unit you will be able to:

1. understand what is digital form ?
2. understand preservation of analog objects by digital means.
3. know that microfilming is a proven preservation technique
4. know the strategy for digital preservation.

14.1 Introduction

Digitization, or digital reformatting or perservation reformatting, has often served as a metohym for all aspects of preservation.: “digital preservation” thus becomes “preservation of analog objects by digital means”. By the early twentieth century, print sources were augmented by new technologies for information capture. Audio was captured on acoustical disks and moving images on film. When digital technologies emerged from computer science laboratories, it offered an efficient new means to store and retrieve information. By breaking analog information into tiny coded dements-bits and bytes – digital technology made it possible to store information of colossal proportions using media that take up very little space. Furthermore, the case with which information can be created and disseminated has led as one might predict, to a bewildering proliferation of information. Now everyone can create and self-publish.

Going digital may be a great thing for those interested in providing information quickly and easily, but from the only worse. Digital information is Vulnerable to a host of new preservation threats. Data recorded on magenetic tape is prone to loss and corruption. Digital data is at risk of becoming unretrievable when the hardware /software configuration on which encoded becomes obsolete. The digital files that are most freqently used have the highest chance of persisting unlike a book on a shelf; a digital file that resides likely on a hard disk for decades or centuries is not likely to be readable when the researcher of the future will try to retrieve it.

India lacks a strategy for the long term preservation of digital information. On scale sufficiently large to support future scholarship and research. A strategy for digital preservation is pan and parcel of any national information policy. What is role of preservation in the library of the future ? Will digital technology overcome all of our preservation problems or will we need to actively manage the accessibility of information ? In a time of rapid change it is hard to predict what the library of the future will look like, let alone what preservation issues and solutions it will enjoy.

14.2 The Existing Role of Preservation

We may define preservation, at least in a library context, as the processes of keeping collections and the information they contain available for use as long-as they are needed. Such a definition begs many questions, of course, such as; available for what kind of use? And needed by whom? However, we believe this is a good enough definition to take with us on this exercise.

Preservation has played an important role in libraries. Because of the “thing” that libraries have collected, preservation has developed with a strong focus on perserving physical material : understanding why materials deteriorate and what we can do about it.

14.21 Why materials deteriorate

The threats preservation is used to dealing with our collections are composed of materials that are naturally subject to deterioration caused or influenced by many things, including :

(I) The materials themselves - acidic papers, poor quality binding materials, unstable media such as cellulose nitrate and cellulose acetate photographic fitms, PVC-based audio tapes,

(II) The environmental conditions we store them in-the heat, moisture, light, pollutants they are exposed to.

(III) mould, insects, mice, and other pests that live on them or in them.

(IV) abuses, or just plain uses of users and staff.

(V) sudden disasters. Such as flood, water leaks, fire, building collapse, vandalism, acts of terrorism, war. We know that preservation is about protecting our collection from such threats, or salvaging and repairing them to compensate for their impact. Of course, our view of preservation, and our sense of priorities, are both influenced by our working context including the kind of collections for which are responsible and the kinds of threat that are most pressing. For example, in kolkata, where the National Library, Kolkata is situated, the climate is hot and often wet; the air is a little bit polluted; we have some insect pests that worry us; we are unlikely suffer floods or eathquakes. We have good building without air-conditioning systems and reliable electricity supply. Our traditional preservation priorities tend to focus on dealing with brittle papers, repairing library materials damaged in being used, dusting and cleaning library materials.

14.22 Preservation Responses

We have a range of good strategies for preventing damage we know that reducing temperature and humidity levels will slow down deterioration and humidity levels will down deterioration and we need to fitter out air pollutants and control exposure to light. We know how to store, package and handle collections and how to train staff and users to do what they can to protect library materials and minimise impact of use. We are aware that we need pest control programme and disaster plan. We have even developed national and international compagins to eliminate the use of unstable materials such as highly acidic paper in publishing and cellulose acetate film in record photography. We have developed good microfiling techiniques and standards that enable us to make reliable and long -lasting copies of unstable materials or items in high demand.

When our preventive measures fail, the conservators have developed some effective treatment strategies that can respond to most kinds of damage for most kinds of materials. Given the right resources, preservation has become one of the mature, functioning areas of libraries, able to draw on a great deal of shared knowledge and some standerd ways of approaching problems.

14.3 Changes in the Context

Libraries are changing in quite profound ways; The information they have access is changing, how they do business is changing and the demands ad expectations of their users are changing. Many of the assumptions upon which library preservation has been based seem to have been changing.

There have been two quite obvious and related changes: the impact of digital technology and where collections might bad.

There are many, other changes happening in our library and information world as will, but these two areas seem to have been particularly interesting and challenging implications for the preservation role.

14.3.1 Digital technology

Libraries have been dealing with digital technology as a collection issue for at least 25 years. We are observing vast amount of information of varying value published in digital formats, and many libraries in the developed world are investing heavily in creating digital version of analogue collection material.

We are to consider the preservation implications of digital technology in libraries, both in terms of managing digital information coming into our collections and in terms of using digital imaging techniques as a preservation tool that might help us to manage existing analogue collections. Greatly enhanced prospects for collaboration between libraries isjust one ofthe doors opened by digital technology This is going to be driven by the demands of users for access to information wherever it originates, but is also driven by libraries themselves, as they look for opportunities to reduce their costs while improving the services they can provide. Collabortion will also be encouraged by survival instinct, as libraries find themselves competing with other providers in an information marketing place. By working together, libraries will be able to energise each other to offer powerful services based on great expertise in finding, defining, managing and delivering information that people require.

14.3.2 Preserving digsta! information

On the surface, digital technology appears to offer few problems in preservation. Bits and bytes are easy to copy, so there should be no problems in developing an unending chain of copies into the nature and having copies all over the globe in case of the cup and the lip and there are very significant technical and management problems. The main factors leading to inacessibility of digital information: changing technology platforms and media instability are relentless, with the potential to render digital information useless. This becomes an acute preservation problems for libraries, because libraries unable to provide access to information have no future at all. Preservation functions will have to much more concentrated on digital collections than they have been so far. Libraries that have a custodial function will need to bring preservation perspectives to bear on the ways. They control digital information from their beginning.

One thing we have to do is to bring digital information into a safe place where we can manage it and have time to make good decisious about its long term preservation. The world of changing websites, unstatable fioppy disks and individual computer system is not a place where any particular digital resource is secure for very long.

Long-term preservation of digital information across generation of technological change is a daunting challenge There is much research going on at a conceptual level, and some practical experiments underway. There is also lively debate between proponents of different approaches. As well as interest in developing standards which dp not solve the preservation problem and new formats that might not be affected by either technological change or the forces -of media deterioration, most attention is being to two approaches: migration (in which files are copied to new operating systems and converted so they can be accessed in each new technical environment, and emulation (in which files are maintained in their orginal formats and accessed using emulation software that recreates their original operating environment)

14.4 Analogue Collections

Digital technology is probably not going to reduce the size of our analogue collection in the tor seeable future. While the number of publications existing only in digital form will continue to grow, it also looks likely that libraries or at least some libraries, will continue to collect growing collections of papers, books, journals, photographs, maps, pointings, films, video and all other non-digital things that go into our collections. Even if these collections did not grow at all, we have our existing large collections of these very physical materials to manage. We have not found any viable large-scale panaceas for the underlying problem of deterioratin: the ieast we can do is to retard its progress and ameliorate its effects. As with digital pieservation, there are some trends generally positive, that are worthy of note. Oven the past thirty five years various mass deacidification processes for

paper collections have looked promising and a number are in experimental or production use in various countries. Mass deacidification is no magic bullet it will not reverse damage that has already happened and it will require repeated application to intrinsically ustable materials like newsprint.

In recent decades there has been a growing acceptance of reformatting as an appropriate preservation tool. It is worth considering the likely contribution of these techniques to preservation in the foreseeable future.

14.5 Microfilming and Digital Imaging

Given the expected long life of the materials, microfilming is often referred to as a proven preservation technique. In recent years there have been improvements in standards, and the widespread filrning of materials such as newspapers that have an uncertain future in ttoeir original format.

However, it is easier to talk about preservation standards for microfilming than it is to achieve them. The apparently easy preservation option of the past thirty years demands substantial inputs, significant planning and a lot of control if it is to achieve its preservation potential

The alternative that has encouraged users to express their dissatisfaction \vith microfilms is, of course, digital imaging. There are two main ways in which digital imaging seems to offer potential preservation benefits: in providing preservation replacement copies for unstable originals, and in providing access surrogates that relieve the pressure of access from valuable or fragile originals. In both cases, the benefit depends on a achieving suitable image quality and on understanding and acting upon the responsiblity to maintain the digital files in an accessible state long term.

Rather than solving all the preservation problems of our analogue collections, digital maging appears to offer some benefits but only if we manage it properly to achieve them, and some potential negatives requiring management. Preservation does not come automatically with the digitisation territory and its net elect is with the digitisation territory and its effect is usually to add preservation burden when one takes into account the long term maintenanc of both analogic originals and digital copies.

14.6 Preservation Role

An effective preservation role in the library of the future will require flexibility, a

willingness to change, proactively seeking a useful rule that draws on the expertise and perspectives we already have, while developing whatever new expertise and perspectives wil be needed. We can expect to have to deal with diversity and ambiguity. And we will need to look for opportunities while being wary of dead-end paths that look promising but lead nowhere. Digital preservation remains relatively undeveloped. Even some developed countries lack a strategy for the long-term preservation of digital information on a scale sufficiently large in support of digital information on a scale sufficiently large to support future scholarship and research. One major problem with digital preservation efforts is that they tend to be fragmented; that is, they do not encompass the full spectrum of digital resources.

14.7 Summary

In this unit we have discussed the existing role of presevatio'n. Why do materials deteriorate? We have indicated how the deterioration can be reduced. We have pointed out the changes in the context and challenging implications for the preservation. Digital technology appears to offer a few problems in preservation. The main factors leading to inaccessibility of digital information have been pointed out.

14.8 Exercise

1. What is the role of preservation in the library of the future? Discuss
2. What do you understand by 'digital version of analogue collection material?
3. How would you preserve digital information ?
4. How does digital imaging offer potential preservation benefits?
5. State the major problem with digital preservation.

14.9 Key Words

Analog : Something varies continuously, like a wrist watch with a sweep second hand.

Digital : means that there are discrete states with no[1] other choices, like the seconds on a digital watch. It consists of numbers and numeric representations, typically binary numbers.

Digital Preservation: There are three different aspects of digital preservation : 1) medium preservation that is, the preservation of the physical media on which bits and bytes of electronic information reside.

2) technology preservation ; 3) intellectual preservation addressing the integrity and authenticity of the informanation as originally recorded.

14.10 Reference and Further Reading

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Unit 15 ❑ Different Types of Binding for Library Materials

STRUCTURE

15.0 Objectives

After reading this unit you will be able to:

1. know what is binding
2. understand different steps involved in binding
3. know various commercial techiques in use today

15.1 Introduction

Binding is a library problem, rather than a departmental problem. For this reason it is not easily integrated into the standard organisational pattern and so has not received the systematic attention'given to other aspects of library service. Recognition of binding as a part of a total programme of conservation, however, suggests that the care of materials might will be given full status as a separate unit of the library's organisation. Such a unit, whether independent or part of technical services department, should provide for a librarian whose position is high enough and whose authority is adequate to command the confidence and co-operation of all other units, In this way, recognition of the overall nature of the problem of binding may be achieved.

15.2 Definition

The ultimate unit of a book printed on paper is a sheet of paper. It yields four, eight, sixteen or more pages of matter printed on it, according to the format of the book. A book consists of several such sheets so arranged that the pages of the book and the signatures of the former run .consecutively. To get it fit for use, the leaves of each sheet should be stitched together. But still this is not suficient. Paper being frail, the leaves at the two ends of the book will fold and theist out of shape. To prevent this sort of condition it should be strengthened by being protected with cover made of a relatively stronger material. For normal books the material used is a card-board'. The card-board is rough for touch. Therefore, the card-board is usually covered with paper or cloth or leather. The totality of these processes is known by the term 'Binding.' Book binding is the process of physically assembling a book from a number of separate sheets of paper or other material.

15.3 Historical Aspect

The craft of bookbinding may have originated around the 15th century A.D. Romans of the time created a form of simple book called a codex by folding sheets of vellum or

parchment in half and sewing them through the fold. Codices were a significant improvement over a papyrus or vellum scrolls, in that they were easier to handle, allowed writing on both sides of the leaves, and could be searched through more quickly.

Later books were bound between hard cover with pages made from paper, or parchment, but were still created by stitching folded sheets at the seam. Since early books were exclusively on handmade materials, sizes and styles varied considerably, and each book was a unique creation or a copy of it.

In the manuscript period binding was carried out by a different set of people other than scribes. Nevertheless the binders had to work under the supervision and instruction of the scribes, because it was the scribes who accepted the order for manuscripts from the customers and had to deliver them according to binding specification of the customers.

The early printers were, however, either binders themselves or ^ any rate had to engage special binders to work for them, who naturally used the printers own devices on their finished books. With the increase in the number of book-sellers, bindings, it seems to us, was separated from the press and the volumes were probably distributed in the form of sheets among the booksellers who then stitched some of them and bound a few others, according to demand. If, however, the printer himself was also a book-seller, he could either undertake the book-binding himself or be in touch with a binder and while selling the copies of his book in sheets to other book-sellers, he used to bind a few copies of the book for sale in his shop. The book-sellers could bind some copies in different style for sale in their shops. Thus the copies of the same style for sale in their shop. Thus the copies of the same book were often found in different kinds of binding.

The publishers binding seemed to have begun at first for the smaller and cheaper books sometimes between 1660 and 1670, Towards the close of the 17the century a good deal of attention was paid to bindings and hence many book-buyers preferred to have their books bound in a style of their own by their own binders. Such was the case throughout the 18th century. Some sort of binding between grey or blue boards with or without a printed label appeared by the middle of the 18th century. At the outset of the 19th century the grey paper boards disappeared yielding place to cloth in the case of books other than fiction. The cloth bindings and the half-cloth bindings introduced much later had, however, printed labels of paper which again soon went out of use in favour of lettering in gold on cloth.

15.4 Necessity of Binding

Before the advent of printing books were considered as precious as jewels and diamonds and they were jealously guarded by those who possessed them. This was because they were at once very rare and costly. Since the production of book was highly time-consuming, every book had to be protected and preseved. So protect the book from wear and tear it had to be given some sort of cover. But as this would give no adequate protection

when the book was being read or handled at random. So some sort of cover as an inseparable part of the book was necessary. Hence the cover was attached to the sewn sheets in order to make a secure unit of the book. This is the form of the book in which we find it even today.

In some cases a library will not have to face any binding problem when information is distributed not in printed pages but in compact discs, and the like. But still today libraries in our country cannot afford to neglect books, journals, newspapers, etc. which form their major stock; Many factors combine to damage books and other printed materials. There are some careless readers who have the habit of turning down the corners of leaves instead of using bookmarks. Improper shelving also does harm to books. The dropping of books from a height injures the sewing and sometimes even cuts the thread. Shabby books often repel the readers. On the other hand, books rebound in fresh attractive covers seem to invite the rea'ders as regards journals, and other prints, which often appear in paper cover they often need to be bound in time because delay in binding them may result in heavy wear as well as in loss of some of their issues. All these factors make it imperative on the part of libraries to undertake binding and repair of their damaged books and other reading materials at proper time.

15.5 Librarian's Responsibility

A library is a collection of both old and new books. Its value perhaps rests more pn old and rare books than on the new books because the latter are easily available, the former are not. Hence many of the old and rare books in existence in a library deserve for more precaution for their safety than the others. Indeed a good deal of knowledge of the past may be best unless these old and vary books are properly preserved. Hence it is the responsibility of the librarian to know how to preserve the old and rare volumes. The knowledge of the best materials and the methods of binding is also essential for a librarian to instruct the binder as to how to retain the old binding, how to reback the broken binding and save the old covers, how to guard the damaged folds in an old book, and decide whether complete rebinding is necessary. He may thus prevent the loss of the great mass of important knowledge about old books which might otherwise be destroyed by careless rebinding. He should know the virtues of different binding materials to give proper instruction to binders and see, when books are returned from ihe bindery, if the instructions have been followed in a cerefu! and workman-like manner. A librarian should know which materials of binding are suitable for different varieties of books and other reading materials and which are likely to endure longer period at the least cost. The knowledge of materials and methods of binding enables a librarian to determine the correct condition of binding fpr storage and preservation of manuscripts and old printed books in leather bindings. He should know how to preserve books from decay, to protect them from atmospheric extremes, form heat, light, and drought. He supervise the work of binders, guide and instruct them in respect of

binding different reading materials viz books, maps, charts, periodicals, cheap books and pamphlets. He should know the craft, he should detect the defects in a bound volume afld get it rebound without incurring further expenditure. The librarian should have also knowledge of different methods of sewing. He should know how to mend torn leaves, how to fill the worm-holes, hold to resize (that is, dip in gelatine size) the pages weakened by damp, how to protect the frail books, which have the heaviest use, by laying over both sides of each frail leaf a strip of finest linen mesh or Japanese tissue which do, : not interfere with the legibility of the text. Thus by the knowledge of book binding a librarian not only saves the life of books under his charge but also considerably reduces the expenditure on binding, thereby saving more money to be more usefully deployed for more important purposes.

15.6 Modern Commercial Binding

There are various commercial techniques in use today Commercially - produced books today tend to be of one of four categories :

15.6.1 Hardcover book

A hard cover or hardbound book has rigid covers and is stitched in the spine. Looking from the top of the spine, the book can be seen to consist of a number of signatures bound together. When the book is opened in the middle of a signature, the binding threads are visible. The signatures in modern hardcover books are typically Octavo (a single sheet folded three times) though they may also be folio, quarto, or 16mo. Usually large and heavy books are sometimes bound with wire or cable.

15.6.2 Paperback book

A paperback or soft cover book consists of a number of signatures or individual leaves between covers of much heavier paper, glued together at the spine with a strong flexible glue—this is sometimes called perfect binding. Mass market paperbacks and pulp paperbacks are small (16 no size). Cheaply made and often fall apart after much handling or several years. Trade paperbacks are more sturdily made, usually larger, and more expensive.

15.6.3 Cardboard

A cardboard article looks like a hardbound book at first sight, but it is really a paperback with hardcovers. It is not as durable as real hardbound ; often the binding will fall apart after a little use. Many books that are sold as hardcover are actually of this type.

15.6.4 A Sewn book

A sewn book is constructed in the same way as hardbound book, except that it lacks the hardcovers. The binding js as durable as that of a hardbound book.

15.6.5 Comb-bound book

The rise of desktop publishing has brought a fifth form. A comb-bound is made of individual sheets, each with a line of slits punched near the bound edge. A curled plastic ‘comb’ is fed through the slits to hold the sheets together. Comb binding allows a book to be disassembled and reassembled by hand with damage.

15.6.6 Magazine

Perfect binding similar to paperback books is often used. National Geographic is perhaps the best known of this type.

15.6.6.2 Saddle-stitching

Stapling through the centre fold, also called saddle- stitching, joins a set of nested folios into a single magazine issue; Playboy (before 1985) is a well-known example of this type, as are most American comic books.

15.7 Modern hand binding

When talking about bookbinding as a craft, handbound books, are most common. Any sewn book can be pulled apart and rebound into a hardbound book by adding a case. Cases are after cardboard and sometimes wooden squares adhered to paper or leather and formed around the text block. There are different methods of sewing, such as stab sewing. A traditional method which uses sashes allows the book to open flat and not break the spine.

Books can be bound in many different materials. Some of the more common materials for covers are leather and cloth (See also; buckram). A common way to bind a book is as a halfbound book, which means that the spine and the corners of the cover are covered with leather or cloth, while the rest is covered with paper (normally marbled or otherwise decorated). When only the spine is covered with cloth or leather and the rest of the cover is covered’ with in paper, the book is called quarterbound.

15.8 Terms and techniques

A leaf is a single complete page, front and back, in a finished book.

The recto side of a leaf faces left when the leaf is held straight up from the spine

The verso side of a leaf faces right when the leaf is hold straight up from the spine

A folio is a single sheet folded in half to make two leaves. The term folio can also be used in the same sense as leaf

A codex is a set of folios nested together and sewn through the fold.

A signature is a large sheet printed with several pages, intended to form four or more leaves in the finished book. The pages are arranged on the sheet so that all of the pages orient the same way and are in proper seqence after the sheet is folded. Arranging these pages correctly is called imposition. (Signature also refers to a sequence number or code printed on the sheet so that several signatures that make a complete book may be properly sequenced; this signature is often trimmed off after binding). The signature may be folded in several ways, depending on the number of leaves it will form; it is then stitched together down the last fold.

A sheet folded in quarto (also 4 to or 4°) is folded in half twice^at right angles to make four leaves.. Also called: 4 -page signature

A sheet folded in octavo (also 8vo or 8°) is folded in half 3 times to make 8 leaves. Also clled : 8 page signature.

A sheet folded in sextodecimo (also 16 mo or 16°) is folded in half 4 times to make 16 leaves.

Also called : 16-page signature.

Duodecimo or 12 mo, 24 mo, 32 mo and even 64 mo are other foldings of a signature. Modern paper mills can produce very large sheets, so a modern printer will often print 64 or 128 pages on a single sheet.

Folio, quarto and so may also refer to the size of the finished book, based on the size of sheet that an early paper maker could conveniently turn out with a manual press. Paper sizes could vary considerably, and the finished size was also affected by how the pages were trimmed, so the sizes given are rough values only

A folio volume is typically 15″ (38 cm) or more in night, the largest sort or regular book.

A quarto volume is typically about 9″ (23cm) by 12" (30cm), roughly the size of most modern magazines. ‘An octavo volume is typically about 5 to 6″ (13-15cm), the size of the most modem digest magazines or trade paperbacks.

A sextodecimo volume is about $4^1/_2$″ (11.5cm) by 63/4″ (I7cm), the size of most mass market paperbacks.

A quire is a set of leaves which are stitched together, this is most often a single signature, but may be several nested signatures. The quires for a single book are arranged in order and then stitched together as a set.

Trimming allows the leaves of the bound book to be turned. A sheet folded in quarts will have folds at the spine and also across the top, so the folds must be trimmed away

before the leaves can be turned. A signature folded in octavo or greater may also require that the other two sides the trimmed.

Deckle Edge or Uncut books are untrimmed or incompletely trimmed and may be of special interest to book collectors.

15.9 Summary

This unit has discussed the deflinition of binding, historical aspect of binding, necessity of binding. It has highligted the responsibility of the libriarian in preserving the old and rare books through the knowledge of binding. It has discussed the various commercial techniques of binding. The unit has thrown light on different technical terms and techniques.

15.10 Keywords

1. Adhesive binding : A binding technique in which single leaves are held together using all adhesive, usually polyvinyl acetate, rather than any form of sewing or mechanical attachment.

2. Folio : (1) A sheet of paper folded once, forming two leaves, four pages. (2) A leaf unnumbered on the recto.

3. Trimmed : The edges of a book are said to be trimmed, only the edges of the larger leaves have been cut, these the edges are roughly levelled rather than smooth.

15.11 Exercise

1. What is publisher's binding ? Discuss the need for binding in a library[9']
2. Why should the librarian be interested in binding?
3. Discuss the different categories of binding in commercial produced books.
4. Write short notes on modern hand binding.

15.12 References and Further Reading

1. Chakrabarti, ML. Bibliography in theory and practic. 3rdrev.ed, World Press, 1987, Chapter VIII.

2. Clough, Eric A. Bookbinding for librarians. London, AAL, 1957.

3. Corderoy, John: Bookbinding for beginners. London, Watson - Guptill, 1967.

Unit 16 ❑ Binding Materials and their Varieties

STRUCTURE

16.0 Objectives

After reading this unit you will be able to:

1. know the types binding materials required.
2. understand the difference betwen ‘mending’ and ‘repairing’
3. understand the meaning of ‘reinforcing’

16.1 Introduction

By this time, ironically, librarians begin to realise that modern books and papers are less stable than older materials. They have also learnt that book-binding is the art of attaching strong cover to the book and other reading materials by means of cords or tapes laced to the sewn sections of the book forthe protection of pages and convenience of reading.

To many people the two terms ‘mending’ and ‘repairing’ appear to be almost synonymous, though there is a good deal of difference between the two. While ‘mending’ does not involve the separation of the book from cover, ‘repairing’ involves partial restoration of a worn or torn volume. By ‘mending’ we mean such work as mending of a tear in a page or tipping in of a loose leaf while by’ repairing’ we understand such work as the repairing of the cover doth, corners, etc. Reinforcing is nothing but the strengthening of the structure of a weakened volume by adding some suitable material. This includes such work as reinforcing of a page by covering it with tissue, strengthening of a hinge with cloth. Rebacking, on the other hand, is a simple process. It is nothing but attaching a new shelfback to a book without any other binding. When the sewing and the cover of a volume are in a good condition but the cover has either come out or loosened, the volume has to be protected by reattaching the cover properly and this is technically known as ‘recasing’. Recovering, new cover and attaching it to the book.

All these features make it imperative for the librarian to take judicious decisions asto whether a particular volume is to be mended, repaired, binding materials should be appropriate and economically feasible. Each piece of material has to be weighed in terms of the intrinsic value of the content, existing physical condition and so on.

16.2 Sewing Material

The best thread for sewing books is linen. Silk, cotton, nylon, dacron, rayon and other threads can be used, but none has proved to be as uniformly satisfactory as linen from Belgium and Ireland. Silk is advantageous when a hand-sewn book has many signatures- The fine silk helps to mimise thickening of the spine, cotton and synthetic fibre threads are quite satsfactory for use in book-sewing machines.

Linen thread is made from the straw of the flax plant. The seeds are first separated from the stalks, and the stems are then steeped in water to remove resinous matter and allow fermentation to take place. After fermentation is complete, the fibrous material is separated from the woody matter and spun into the strong, even thread so long preferred by the hand bookbinders.

Synthetic threads are made by extruding plastic material into chemical bathes where it is congulated into a continuous thread before being dried and taken up on spools. Like cotton threads, they are highly refined products of uniform quality, but without strength and durability of linen.

16.3 Materials for reinforcement

Spine reinforcing materials include crash and flannel. Crash also known as super, is glued to the spines of some books to strengthen them and reinforce the hinges. On some machine-made books it is the only hinges. The open weave or the fabric permits the glue to strike through easily, and the lining gets a good grip. When more strength is required canton flannel, which is fleed on one side is used in place of super. In case of rebinding it involves strengthening of the structure of a weakened volume by strengthening the hinge with cloth, reinforcing delicate pages by using tissue. Of course, the covering material should be of a superior standard. It is applied in case of valuable publication and this type of binding is called ‘library binding.’

16.3.1 Thread Gauge and Buckram

A closely woven cotton-mesh is pasted along the spine by means of glue in order to strengthen the connecting cardboards and to increase the longevity of the binding. This material is called ‘thread-gauge.’ The fabric used for strengthening the connecting boards as well as for reinforcement of the folds of end-papers or spine should be of unsized cotton.

16.3.2 Tapes and cords

The tapes and cords to be laced in to the cardboard should be made of unbleached linen or cotton of good quality. They should be unsized and free from loose threads or other

manufacturing defects As regards the number of cords or tapes that depends upon the size of the book. They are usually five on most bound books, but there may be six or even seven on tall books, and only three or four on books that are short.

16.3.3 Endpapers and Paper for Guarding

These are free handmade paper or book paper or ledgerpaper of good quality. This paper should be smooth and strong. It should not crack along folds.

16.4 Adhesivcs

Undoubtedly primitive men made use of the adhesive properties of saliva, waxes, resins, egg whites and bitumen in their everyday living. In is unknown when they first learned that by cooking animal skins in water one can obtain a sticky substance (glue) useful for holding thing together. In the process of binding, adhesives play a vital role. The common varieties of adhesive used in book binding work are.

16.4.1 Starch Paste

Flour or starch paste is cheap, easy to prepare and is excellently suited to paper, cloth, various cloth-based products. The paste should be acid free and has insect repellent content.

16.4.2 Dextrine Paste

This paste can be used conveniently for repair work.

16.4.3 Glue and Gelatins

Glue is the result of the hydrolysis of the protein collagen, the main constituent of the inner skins of animals Glue and gelatines, both colloids and chemically alike, merge into one another by imperciple degrees. Gelatin is an excellent adhesive, but is even more valuable as an additive to paper Animal glues have ben largely replaced in book binding by PVA (Polyvmyl acetate) glues, made from synthetic polymers. They dry rapidly and do not provide a food

16.44 Synthetic Adhesives

Polyvinyl acetates are synthetic resins (polymerized vinyl acetate molecules) first made in Germany in 1913. These odourless, tasteless, non-toxic, non-corrosive, non-crystailine, durable materials adhere well to both porous and non-porous surfaces and remain flexible after setting.

After setting they can be Hquified in certain solvents, but even so, are extremely difficult to remove from leather and paper.

16.5 Covering Materials

There are now different kinds of materials used for covering books, but of all these materials leather appears to be very clearly the ideal and most popular. It is pliable and takes tooling in gold admirably. Besides being tough and durable, it is good to look at and delightful to handle. A good cloth is used for agood majority of ordinary books. Nevertheless, for the largest and most heavily used books, leather is still the most durable material for book cover. But if leather is cKosen, it should be first ascertained that the leather or skin to be used has been properly tanned to make it from sulphuric acid which is largely responsible for the decay of leather bindings It should also be ascertained that the skin has been dyed with fast colour so that it can stand both light and moisture. At present the following kinds of leather are used for binding purposes.

16.5.1 Sheepskin

It is rather soft on the surface and has little strength. It is, therefore, good enough for binding books for which only a short life is required. In any case it should not be used for permanent preservation of books.

16.5.2 Goat-skin

It is perhaps the most suitable of all skins for library use. This is popularly known as morocco which has derived its name from the country, Morocco. It is highly expensive and hence it is reserved only for valuable books.

16.5.3 Pig-skin

It is an excellent leather, very thick, strong and durable. This is used specially for binding manuscripts and books of special value. Pig skin should not be dyed because in its native colour it takes on a pleasant ‘chesy’ tone and has a smooth hard surface.

16.5.4 Calf-skin

Young calf has a perfectly smooth surface, but little strength. There is some calf-skin of inferior quality known as “tru-calf which is used for binding ordinary books.

16.5 Vellum

Vellum is a good binding material. It is prepared from the membrane of calf-skin dressed with alum and then polished. It has a beautiful, creamy-white surface which takes gold-tooling so no other background can do. Vellum bing costly connot be used for the general run of library books.

16.5.6 Parchment

Parchment is also a similar product, but not so strong as vellum. As it is made from spilt sheep-skin, it is thinner as well as weaker than vellum, and hence it does not make a good covering material.

16.5.7 Seal-skin

It is the hide of the Greenland seal and not of fur-bearing, kind and is very strong all throughout. Its oil is very—and consequently it is both durable and flexible. But it is too costly to be used for ordinary library binding.

16.6 Substitutes for Leather

Since leather is too expensive for the covers of a great majority of books, a large variety of substitutes have now come into common use and they are quite suitable for modern needs. Of these, the group of textiles seems to be the best. They include cotton and linen cloths and cotton and linen buckrams.

16.6.1 Buckram

Buckram is made from linen or cotton fibre, closely woven and suitable filled coated and calendered. As a binding material buckram is indeed a class by itself. But asit is thick and fairly stiff, it is suitable for covering only large and heavily used books, such as large reference books, big volumes of periodicals, etc.

16.6.2 Cotton Cloth

Cotton cloth known as Calico is sometimes used for the front and back of the book but not for its spine.

16.7 Materials for Ornamentation

In the past thin gold leaves were used for gold lettering and ornamentation on the cover of the bound volumes, presently gold lettering and ornamentation are not encouraged. Gold tooling is done with leaves prepared by an alloy of gold, copper and silver

Silver tooling is done with thin silver foils.

Printing is done with letterpress pinting by using prigments of any chosen colour.

16.8 Summary

This unit discusses sewing materials, materials for reinforcement and various kinds of covering materials. Finally, ornamentalion on the cover of the board volume is done.

16.9 Exercise

1. Distinguish between mending and repairing.
2. Show your acquaintance with different types of binding materials.
3. How are synthetic threads made ?

16.10 References and Further Reading

1. Chakraborti, M. L: Bibliography in theory and practice. 3rd rev. ed. World Press, 1987.

2. Ranganathan, S. R.: Physical bibliography for librarians. 2nd ed. Asia Pablishing House, 1974.

Unit 17 ❑ Binding Process

STRUCTURE

17.0 Objectives

After reading this unit you will be able to :

1) understand the binding process and the.various steps involved in the process
2) judge binding witri regard to the instruction given to the binder
3) Know a number of standards for binding.

17.1 Introduction

In the case of an old book that comes to the binder much is to be done to it before the leaves can be sewn. First; it is to be pulled to pieces and then it is to be collated to see if it is perfect. That is to say, if a section is missing, that has got to be supplied; if there is any fault, that is to be rectified, if a section.is misplaced, that is to be rearranged and so on. If then it is found that the backs of some sections are damaged, they should be properly 'guarded' by laying over them strips of strong, thin and flexible material like linen or bank note paper so as to hold the threads. If again, the paper of a book is found to be very soft, it should be 'resized' by passing each pair of leaves through a solution of gelatine and then hanging it up on a time to dry. If dust and dirt be found on pages, this can be removed by the careful use of soft India-rubber. If on examination of a printed book, it is seen that some pages are highly damaged, they can be strengthened by pasting over them strips of chiffon, which are hardly visible if properly put down.

There is also perennial financial problem, which most libraries suffer from. This problem often restricts the binding activity in a library. All these problems make it imperative for a librarian to decide which, a particular volume is to be bound or rebound at all or not.

In the case of 'edition binding' in which mending or repair work is not involved, the method is a little more difficult.

17.2 Binding Process

There are three stages in the work of binding : Sheet work, Forwarding and Finishing of which first one includes folding, gathering and sewing. Sheet work is the generic name of three operations : folding, gathering and sewing.

17.2.1 Folding

Binding operation practically begins with the folding of the sheets. In the case of some limited editions of the private presses, the printed sheets are folded by the binder himself, otherwise it is done by a folding machine which folds the sheets into sections. Each sheet is folded in such way that the pages appear in correct sequence. Each section consists of sixteen pages though sections consisting of thirty two pages are not also rare. In many old books they sometimes contain only twelve pages. The first page of each section has often at its bottom, signature which consists of either a single small letter or a small letter or a number following it. Now, whatever that may be, its purpose is to provide some guidance to the binder about the correct order of the pages. The letter 'j' V and 'w' are not used. Strong front papers are provided at the front and the back.

17.2.2 Gathering

The folded sheets are sent to a collating machine which gathers them in correct order. In the case of all superflow pages, such as advertisements, etc. are to be discarded, and all wire-stitchings, if any, removed before gathering.

17.23 Sewing

After gathering in correct.order, the folded sheets are sewn together into a complete book. The sewing, in the words of Erdaile (students M annual of Bibliography, P. 192) is “the essence of the whble craft and if it fails, all fails,) and the book falls to pices. Indeed the strength of the book as well as its longevity depends on how it is sewn together. There are various methods of hand-sewing. One of the commonest methods is to sew the sections on a sweing frame or press. The vertical cords on this frame are principally meant for fastening the book to the boards. After stitching of each section, it is knocked down a loaded stick so that e ‘en tension may be given .all through the sewing. In most of the 15th century books double cords or thongs of leather were used, but now stout string is more common. Books were sewn on these cords or leather thongs by a figure-of-eight stitch. But as this method, though very strong, was a slow one, it was used only for sewing highly expensive books.

17.2.3.1 Cords

The modern, ‘flexible ail-along’ sewing on single cord is in fact “direct descendant of the ‘figure-of-eight’ early sewing”. In this sewing the thread passes through the fold of the first section and round the cords from head to tail, then across to the next section by means of a ‘Kettle stitch’ and up to its head. In this way it continues up and down across the entire spine of the book. When all sections are thus sewn, the cords are cut, leaving, some short projecting ends called ‘slips’ at each side, so that they may be firmly secured to the boards.

17.2.3.2 Tapes

Sewing on tapes is yet another sound method. It is mostly used for library binding.

There is a still a simpler way of sewing in which neither cord nor tape is used. It consists of a single thread going perpendicularly up and passing through the fold in the middle of each section to hold several pair of leaves in each section together.

17.2.4 Forwarding

The binder divides the processes of his craft into two halves: ‘Fowarding’ and ‘Finishing’. A book goes through various operations between the sewing and the finishing. These operation are known as ‘forwarding’. The principal operations involved in forwarding in a hard-bound book are pressing, gluing-up, founding, backing, attaching the boards, trimming, covering and fiiling-in.

17.2.4.1 Pressing and Gluing-up

After the book is properly sewn it has to be compressed and consolidated either by pressing it in a machine known as Nipping Press which is capable of exerting nearly ten tons of weight or by rolling it between heavy steel rollers. This can also be done by beating it with a big hammer. The purpose of pressing is to give the book a well shape. The next process is gluing. The back or spine of the book is given a coating of glue which is applied in such a way that it penetrates between the sections and helps to hold them together. The glue is allowed to dry until it becomes elastic.

17.2.4.2 Rounding and Backing

Rounding is carried out with a hammer until it assumes the correct shape, and the degree of roundness depends on the amount of swelling.

17.2.4.3 Attaching the Boards

The next process is to attach the book to the boards. The boards in which the book is to be bound are cut to size, lined with paper and laced on. The boards are then pierced and through the holes, (two for each slip) the slips are threaded and hummered flat on the board and glued in position.

17.2.4.4 Trimming

The next process is to cut the edges of the book. The edges are generally trimmed with-a plough as accurately as possible by leaving suitable margin. The square boards at all times act as guides to the cutting. In hand-bound books only the head is normally trimmed, but for special purposes all the edges are sometimes trimmed. Triming in the latter case is done at the head, then at the tail and finally at the fore-edge.

17.2.4.5 Gliding

Gliding the edges, if desired, should be carried out soon after trimming. Gliding is done either by brushing or spraying the desired coloured ink, and then by waxing and barnishing it or by scraping the edges in a small finishing press, and then applying a liquid bole with a sponge and lastly by laying over the dry surface a sheet of gold leaf.

17.2.4.6 Covering

The treatment that still remains to be done is to cover the volume with suitable covering material. The covering material, whether leather or cloth or^any other variety is pasted or glued to the boards and turned in. If leather is used, a rectangle is cut large enough to cover

the volume in one piece. And to have sufficient margin on all sides for turning in. For spine the leather is moulded round the cords and turned between them as. Smoothly and neatly as possible because it is the cords that form an integral part of any decorated binding.

Finally end-papers are to be added. An end paper is a sheet of strong paper which is double the size of a leaf of the book. One half of this end paper is now pasted down on the inner suface of the board so that it may be equal to the thickness of the leather turned in, and the other half is left free so that it becomes virtually the first leaf of the book. An end paper performs the double function: it hides the reader fpom the mechanism of binding ; it prepares him for the things lying just beyond it.

17.2.5 Finishing

This is the last step in the binding process. This implies then finishing touches that are given to the book after a secure unit of the book and the cover is obtained and this includes all the beautification processes like lettering, decoration and polishing. Normally the volume is lettered with the title, the author's name and the call number by gold-tooling on the spine. Books may be lettered by hard-stamps or brass stamps set in wooden handles. There may bye different other methods of decorating the binding, such as inlaying of different colours on leather, gliding and colouring the edges.etc. Lastly comes polishing of varnishing which gives the book a finished look and attractive appeaance.

17.3 Library Binding

It is a special kind of binding known as extra or luxurious binding, which imparts great strength and much durability to the book so that it may withstand severe library use. The sewing in this case is done by hand, but if there are enough books to be bound £t one time, sewing can also be done by machinery. Normally cords are used and laced through strong black board, but if necessary, even tapes may be used and laid with glue between split mill-boards one of which is thick and the other thin. As regards covering leather even imperfectly dyed skin may be used as it does no harm. Lastly, even thicker leather can be used with the help of French joint.

17.4 Publisher's Casing

It is the same as case Binding. It is different from bmding altogether because the case in this method is made separately and then lightly attached by glue to the book.

17.5 Judging a Binding

In order that a librarian may obtain good work form the binder he must be able to

evaluate the binder's work by judging the binding properly. While examining a binding, the first task of a librarian is to see if the book has a fine general appearance and a tidy book. The second step in examining a book is to see if the book opens reasonably well or not. If it does it is well and good, but if does not, it is certain that there is something wrong with the sewing or the backing. Flexibility on the whole, rests on the avoidance of tight-back and the use of end papers and covering material in the proper direction. The third step is to open the book and examine whether one can see down between the back of the binding and the back of the book. If one can see it is a ho'.low back, whicrrmeans that the binding is weak because the strain in it has been put only over the joints and not over the whole spine as it is done in tight back binding.

The fourth step in examining a binding is to see if the book is cased or bound. If the book is bound, there should certainly be some evidence that the slips have been laced properly into the boards. In case of cased books it is often seen that the case and the book part company too soon while in case of a properly bound book the connection between the book and its cover is permanent.

The fifth step is to examine the stitches as they appear along inner margins. For a properly done binding the stitches are at a uniform distance and appear to have been done in a neat manner.

The sixth requisite of a well bound book is that it should be capable of standing on its head or tail or foredge without falling over. Lastly, the end papers are of the same colour and weight as the pages of the book. The superiority of binding lies in both good materials and efficient manufacturing.

17.6 Standards for Binding

A librarian who wants to preseve books must be able to give specification for binding books of different nature and importance to his binders and then to judge if the binder has faithfully followed his instruction in this regard or not. Dr. S. R. Ranganathan in his book "Physical Bibliography for librarians" viewed from the angle of binding, a book as a chain of eleven links. It is a symmetrical link with paper as the central link. Of the eleven links, the paper on which the book is printed has to be accepted by the librarian and the binder, exactly as it is found in the book. It therefore follows that the quality of materials used to form the remaining links should be commensurable to the durability and the strength of the paper of the book bound. The parts of a bound book needing attention are Paper (in the centre) thread, tape, end paper board, covering material. For example, any one of the elements is strong and others are weak, the binding will break soon. There are a number of standards or various aspects of binding. We note here three standards:

(a) American Standards prepared by the American National Standards Institute (ANSI) and Nationl Information Standards Organisation (NISO).

(b) British Standards prepared by the British standards Institute in 1980 with amendement in 1989.

(c) Indian Standards Institution brought out its publication 15:3050-1965 a code of practice for reinforced binding of library books and periodicals with amendment in 1968.

17.7 Summary

In this unit we have discussed the various steps involved in the binding process which includes folding, gathering, sewing, forwarding and finishing, Library binding, an extra or luxurious binding and publishers casing have also been discussed. Evaluation of binders work is also an important aspect of a librarian's job. Different steps in examining binder's jobs have aslo been discussed.

17.8 Exercise

1. What are the stages in the binding process?
2. Discuss the steps involved in the binding process?
3. How are end papers added to the binding ?
4. What are the steps injudging for binding ?

17.9 Keywords

1. Binding of library books: It consists of different types of binding used for different types of materials having different physical forms and intrinsic value.

2. Case: A protective cover made separately and then attached to the book. It is the cover of a book, printed, stamped and made the proper size to be attached to a book.

3. Case Binding: The process of preparing the cover separately form the text, then attaching it to the text.

4. French joint: A french joint is a free swinging joint produced by setting the cover board a little distance away from the raised edge. It is a also known as open joint.

17.9 References and Further Reading

1. Chakraborti, ML.; Bibliography in theory and practice. 3rd rev. and enlarged edition, World Press, 1987.

2. Clough, Eric A: Bookbinding for librarians. London, Association for Assistant librarians. London, Association of Assistant Librarians, 1957.

3. Ranganathan, S. R. : Physical bibliography for librarians. 2nded. Asia Publishing House, 1974.

Unit 18 ❑ Preservation Unit

STRUCTURE

18.0 Objectives

After reading this unit you will be able to:

1. know that a large or medium sized library should have a preservation unit.

2. understand that the preservation unit has to take care of general preservation problems of the library.

3. know that the preservation unit should have an additional section to take creative measures.

18.1 Introduction

The collection of any library may be broadly divided into two parts-the service part and the storage part. The service part is meant for the current materials which are frequently used. A portion of the service part is weeded annually, since these materials are frequently

taken from the shelves and replaced there is the least possibility of chemical deterioration or biological damage, except the materials are affected by physical stress due to handling. This part of library collection does not face much preservation problem. But storage part is kept in the library for a long time and these are not frequently used. Therefore, this part is susceptible to physical and chemical deterioration and biological damage.

The primary jobs of preservation unit are to take care of thfe total library collection to take all preventive measures when materials are damaged. The preservation unit should look after the housekeeping of library materials. All preventive measures for all kinds of materials should be taken as a matter of routine. There are many common problems of preservation in all kinds and sizes of library. Every library has got certain specific problems because of storage condition, kinds of library materials, physical nature of the documents, physical condition of books and other materials, building prove to insect infestation, condition of old building and such other factors. The preservation unit has to take care of the general preservation problems along with the problems peculiar to that particular library.

Before beginning work on any book repair, a suitable work space should be set up. Whether it is small or large, simple or elaborate, the work space is made up of three basic components: bench area; lighting; tools, supplies and equipment.

18.2 Bench Area

Most professional book repairers prefer to work standing up for better leverage and control. A surface of approximately 6 feet by $2^1/_2$ feet is adequate; the height should be comfortable for working. Many laboratories have steel legged tables placed in adjustable wooden blocks. These should be wooden barstools or adjustable chairs as seating. The surface should be resistant to scratches and easy to clean such as a laminate or formica. In addition, adequate stage for supplies is required. Large and heavy items, such as stacks of binder's board should be stored horizontally to help prevent warpage.

There are also economic ways to accommodate storage of tools and supplies. A tiered carrousel is handy for holding tools. It is high enough for long-handled brushes, and the individual compartments provide quick access to different tools. A kitchen drawer sepatator allows a suitable storage container for blades, knives, and other sharp objects. Margarine tubs with lids are necessary for-holding glue and paste; an empty, liquid detergent bottle is a handy glue container.

There should be provision for storage of large equipment. This wood include paper cutter, book press and a laminating machine. A sink is a necessity for any workroom for cleaning brushes and containers and for providing water or making paste.

Natural light is the best for book repair work space. Besides giving the least distortion, it provides a good work atmosphere.

Depending on the condition of the library materials and deterioration and damage caused to them, the library may require an additional section of the preservation unit to take

curative measures for the library materials, such as deacidification, repairing, mending, fumigation, laminatioin and the like.

18.3 Tools, Supplies and Equipment

Tools, supplies and equipment depend, on the treatment decisions. For the best conservation treatment any decisions must be judged against three criteria: harmlesness, reversibility and durability. Fortunately, as library supply dealers become aware of and concerned with preservation needs, an increasing number of tools, supplies and equipments are satisfying these two extremes. That is, many conservation alternative item's are now easily obtainable and within the budget constraints of libraries. The preservation unit should have the following tools, supplies and equipments to start with. Other items may be added as and when required.

18.3.1 Tools

1. Repairing table with glass top.
2. A few medium and small pots of enamel or glass to keep paste for repair and mending jobs.
3. Several horse hair brushes of various sizes to apply chemical, etc. It is best to have an assortment of brushes. The four most useful are the oil painting brush (with a small flat tip, a Japanese water colour brush (with a pointed tip), a glue brush (with a round tip), and a hake brush (a broad flat tip). In addition, a long-handled dusting brush is useful for cleaning work room of eraser particles and dirt.
4. Scissors, standard and small: two sizes are needed-a standard pair and small pair, such as embroidery pair.
5. Knives and Blades : A scalpel knife is essential for many repairs. A heavier utility knife is needed for cutting boards. Large knives are needed to cut a number of paper sheets at a time. Scalpel blades are the most used for book repair work
6. Steel and plastic scales
7. Large and medium brass or aluminium pots to cook paste.
8. Pots for dextrine and CMC pastes
9. Enamelled trays of various si/es for cleaning paper sheets.
10. Wooden rack for drying sheets.
11. Plastic and brass nets-of various sizes
12. Small hand press to exert pressure
13. Class and enamelled cup and saucers
14. Needles ofvarious sizes for sewing. A stiff needle in a wooden and plastic shank used making small holes
15. Bodkin or sharp nail for making holes on paper sheets,
16. Foot rule

I7. Analytical balance

18. Paper cutting machine

19. PH meters to determine paper strength

20. Micro-spatula: A thin double-bladed spatula useful for applications of small amount of glue and for other repair procedures.

21. Tables for cooking glues and for pressing

22. A drying oven or some other device for drying paper sheets.

23. Hot plate or oven for boiling paste.

24. A moisture chamber (hydrostat) for the paper

25. Almirah for storing materials

26. Cabinets for storing chemicals and solutions

27. Bowls to keep paste (100ml)

28. Bowls to keep water (250ml)

29. T-square or Triangle: It is a method of making square comers and perpendicular cuts. T-squares are useful for squaring large pices of paper and board, which triangles are better for smaller application.

30. Tweezers: An assortment is the best, including one blunt-nosed pair, one straight sharp-nosed pair, and one curved sharped-nosed pair

31. Wrights: Both small and large wrights are necesary They may be bean bags, cloth filled with shot, paper wrights or bricks covered with felt

32. Metal plate of 25-30 cm. to be placed underneath the book leaf to be treated. A zinc-plated iron sheet is suitable.

33. Pencils.

34. Soft and medium erasers, rubber and synthetic

35. Cottonwool, hygroscopic

36. Porcelain qr wooden rod or spoon for stirring paste

37. A 1-2 litre porcelain pot for the si/ing preparation

18.3.2 Supplies

1. Bookcloth : Many types of bookcloth are available, including library buckram, linen, etc. Virtually all are acceptable and should be chosen according to structural, aesthetic and financial needs.

1. Board : The most common are barrrier (phase box) binder's mat board, etc. They are available in varying thickness and wrights.

3. Cleaning pad : Several brands are available

4. Cloth : Closely woven unbleached muslim, linen, Cambrics, etc. are used in hinge and spine repair

5. Glue : Many suppliers are now offering acid free book glue along with their regular products.

6. Cleaning pad

7. Heat-set Tissue : A finely woven tissue with heat activated adhesive

8. Non woven (Spun) Polyester. Also known generally as release cloth and spunbounded polyester It is used for a non-stick surface.

9. Paper: Several kinds of paper are necessary for book repair. It includes blott ig paper, glassine paper, oil paper of glazed paper inserted between sheets during pressing.

10. Paste : For archival mending either rice or wheat starch in used.

11. Polyester film : This film is commonly known as mylar, even though Mylar is actually a registered product name from due Pont. It is not a plastic but an inert polyester that is used for bookwraps and jackets and for encapsulation

12. Book Tape : Book tape comes in a wide variety of styles, colours, and strengths. It is also cut into specific shapes, such as wrings.

13. Tape for paper : There are also several types of tape available for mending paper, the most common of v/hich is Magic Transparent Tape.

14. Thread : It is to be used for sewing signatures and pamphlets.

18.3.3 Equipment

In a large library or in a library hairing a considerable storage part a laboratory in addition to work room should be established particulary for restoration and for taking curative measures. The necessary equipment, furniture, materials should be collected.

1. Working bench
2. Fumigation cabinent
3. Balance, ordinary .
4. Balance, analytical
5. Water distillation unit
6. Deacidification unit as required
7. pH meter (Beckman or Pye model)
8. Microcope
9. Deacidification bath trays
10. Hotplates
11. Electric mixer
12. Folding Endurance machine
13. Ultra-violet Lamp
14. Table for deacidification, electrically heated
15. Stainless steel or plastic wirenet support for washing
16. Large enamel trays
17. Steel Wirenet plates

18. Board Shear : A heavy-duty precision culture for bindier’s board, barrier board, and havey paper. This is an expensive piece of equipment, but it is essential for creating hardback bouks, case bindings.

19. Book Press : There are several kinds, but they are suitable for smaller books. Large books can be pressed through the use of wrights and wooden boards.

20. Laminating machine : It is excellent for protecting flat materials that get a lot of

use but are expendable. It is worth to note that the heat frqm the laminating process activity indicates the destruction of the paper the process is meant to protect when, in doubt, it is better to prefer encapsulation.

21. Paper cutter : It is useful for cutting all types of paper but may also be used for polyester film and their barrier board.
22. Glassine paper
23. Tissue Paper
24. Chiffon
25. Cellulose acetate foil
26. Acetone
27. Repairing and mending tools and materials.

The laboratory can start functioning with those materials as noted above. Additional materials can be collected as and when necessary. Before collecting the materials the expert or Head of the preservation unit must be consulted. He is the right person to suggest the equipments and materials. The work room and laboratory should be located in a remote part of the library building. Rooms should be will-lighted, both naturally and antificially, as well as ventilated. Exhaust fans are required in the room. Working persons should be provided with aprons, gloves, fume hood for the chemical treatment of the paper sheets and for work with very toxic substances and other materials to take precautionary measures while working in the workroom and laboratory. The persons should be trained in personal hygiene and the nature of the chemicals and their effects on human body. Adequate first aid arrangement should be ready at all times to cope with any emergency. Proper fire extinguishers and fire fighting equipment should be kept in preservation unit of the library.

18.4 Chemicals

Chemicals required for both preventive measures and curative measures should be collected and should be kept in a classified order for respective uses, when solutions are to be prepared the proportion of mixture should be strictly adhered to. Instructions and directions printed on the containers should be properly understood. Necessary precautions should be taken for storage chemicals, and solutions must not be kept in containers without proper labelling. In case of solutions data and time of mixing must be mentioned on the container labels.

18.5 Observations

Preservation is a specialised job involving 3E’s, namely. Expertise, Efficiency an.1 Experience. In fact, these three qualities are essential for performing the proper job in the right way. Any work done with mistake cannot be sometimes rectified. If rectification is to be done, this will be both expensive and harmful to document. Knowledgeable persons must

be consulted for any specific job because each and every job has its own tools, equipment, material, method skill and expertise. Presentation is both science in basic knowledge and its application, and art in manifestation of the knowledge, training, expertise, skill and handwork leading to achievement of all objectives.

Preservation begins with selection. In fact, selection routines should incorporate preventive activities. Selectors should practise 'preventive preservation' whenever possible. In making the original purchase decision, every effort should be made to acquire materials that have the best chance of sarvining in the library's environment. Selectors need to take into account such factors as quality of paper, size, format, type of binding and potential use. As current acquisitions are received those items that arrive in poor condition should be indentified and decisions made at that time as to whether they should be stored in a protective container, microfilmed, photocopied or even discarded if cost cannot be justified.

3 T's namely, Time, Thought and Technical expertise along with money must be used up but not necessarily to an extent excessive in proportion to the value of a collection. Thoughtless neglect can easily result in the ruin of rare, beautiiul and treasured documents.

18.6 Summary

In this unit the have discussed the preservation unit which a larger of medium sized library should hold. The preservation unit takes care of the general preservation problems of the .library. We have noted thirty seven preservation tools, fourteen supplies and twenty seven equipments to be organised in the preservation unit. An adequate first aid arrangement, proper fire extinguishers and fire fighting equipments should be kept in the preservation unit. Preservation should begin with the selection of library materials. In making the purchase the librarian should select those materials which have the best chance of surviving the library's environment.

18.7 Exercise

1. Why should a large library have a preservation unit?
2. What are the curative measures a libary should take?
3. How does the librarian organise the preservation unit for his library?
4. Dipcuss the physical conditions of the room in the preservation unit.

18.8 Reference and Further Reading

1. Chakrabarti, B. and Mahapatra, P. K. Library Collection : selection and preservation. World Press, 1991.

2. Mahapatra, P. K. and Chakrabarti B : Preservation in libraries : Perspective, principles and practice. Ess Ess Publication, 2003.