BHHM 09

VARDHMAN MAHAVEER OPEN UNIVERSITY, KOTA

House Keeping Operations

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BHHM – 09 House Keeping Operations

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LINEN ROOM

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1.1 INTRODUCTION

LINEN is a very essential part of the housekeeping department; it is like a assets to the department as its purchase cost a lot and requires a lot of research and experience to get the right quality of linen. As linen is expensive to be replaced lot of care needs to taken to for its maintenance, laundering procedure and its storage. If the Linen used in the guest room appears to be yellow in appearance, torned or give a worn out look, the overall look of the room will never be appealing –the bed will not look presentable and ultimately the guest staying will not be able to satisfy himself in spending money to stay in the hotel.

Linen is used in rooms, restaurants, spa, pool side, gym, making of staff uniform etc. Efficient linen and laundry management ensures that large volumes of soiled linen are washed and treated so as to look neat, smell fresh, and feel crisp so that they are disbursed at the right time and to the right place. Linen room forms an important part of the laundry department and staff personnel are assigned with different responsibility to carry the functioning of the linen room smoothly and efficiently.

LINEN ROOM ORGANIZATION

There are usually two types of linen room:

1. CENTRALIZED LINEN ROOM

2. DECENTRALIZED LINEN ROOM

1. CENTRALIZED LINEN ROOM

   In this type of setup, there is only one assigned area where linen from all floors are collected and sorted. This area also distributes clean linen articles throughout the establishment. The linen room supervisor has complete control over the linen room. All linen issues and receipts go out from here.

2. DECENTRALISED LINEN ROOM
   In this type of setup, each floor maintains its own stock of linen. as in when required the linen need is fulfill by coordinating with the main linen room. The linen par is stored in floor pantries, and the floor supervisors are responsible for maintaining the par level. This setup works well in large hotels were workload is more and there is more number of floors. This system is used in most of the resort property also where each room is away from each other.

1.2 Activities Of The Linen Room

There are many activities which is followed in the linen room. When all of them are addressed carefully the linen section becomes efficient.

1. COLLECTION

This part deals with collecting soiled linen from different areas like pantry with the help of linen chute, canvas bags, linen trolleys, and carts. This is an important activity especially when laundry is on contract. Guest linen or laundry is also collected from respective guest rooms followed by billing and marking.

2. SORTING AND COUNTING

Sorting is carried out to make the laundry process=s easy and simple. Linen is sorted according to the size, texture, stains and color. Linen is counted in order to make a record so that issuing to departments may be accurate and it is possible to tally the exchange of linen between the linen room and the laundry and a basis for billing requirements.

3. PACKAGING

Linen articles are packed in linen sacks to prevent any kind of damage. Those linen articles who needs extra attention like heavily soiled or stain ,requires mending process can be segregated in different color coded sacks.

4. CHECKING AND INSPECTION

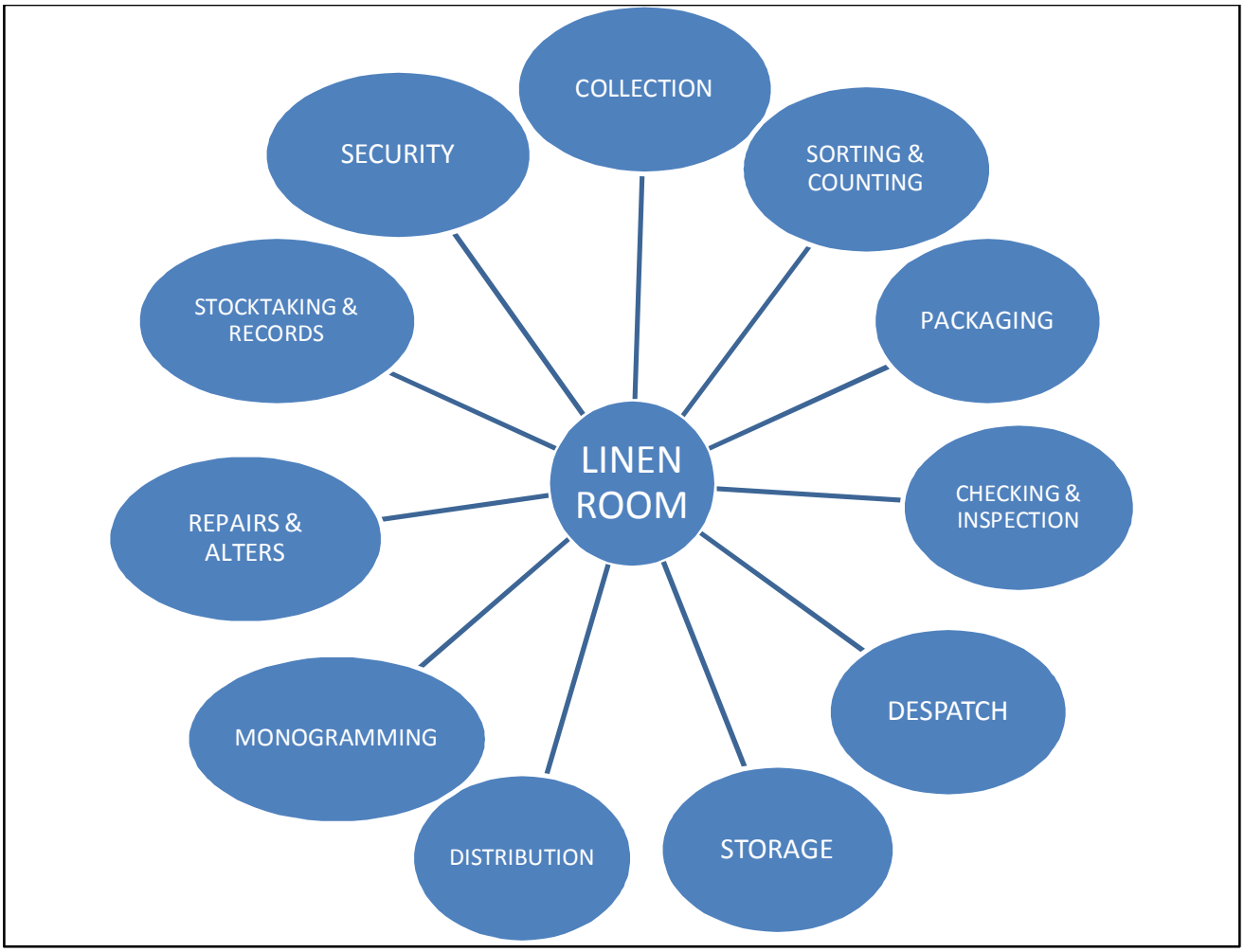
Checking the quantity to ensure that the amount of fresh linen issued in the exchange tallies with the amount of soiled linen articles received. Inspection of the quality wash i.e. stains and dirt removed, no damages, no loss of shape or color, no blue streaks or patch from the optical brightener, properly ironed.

5. DESPATCH

This is mostly applicable to hotels which have off –premises laundry .The time for dispatch is usually fixed so that fresh linen can also be received on time and it does not hamper servicing of rooms or linen which is required in restaurants ,spa etc.

6. STORAGE

The linen article which is watched and inspected needs to stored properly if it is not be used immediately or becomes the part of circulation. It needs to store in dry conditions where humidity level is not high and at a very hygienic place, so that the linen article does not carry any foul or musty smell.



7. DISTRIBUTION

The linen which is laundered is distributed to different areas of need at a stipulated time ,for the smooth functioning of operations.

8. MONOGRAMMING

Linen which belongs to the hotel needs to be monogrammed so that it is not misplaced and extra caution is given to maintain the linen.

9. REPAIRS AND ALTERS

The maintenance of the linen requires constant repairs and alteration according to the requirement which is offered by the linen room.

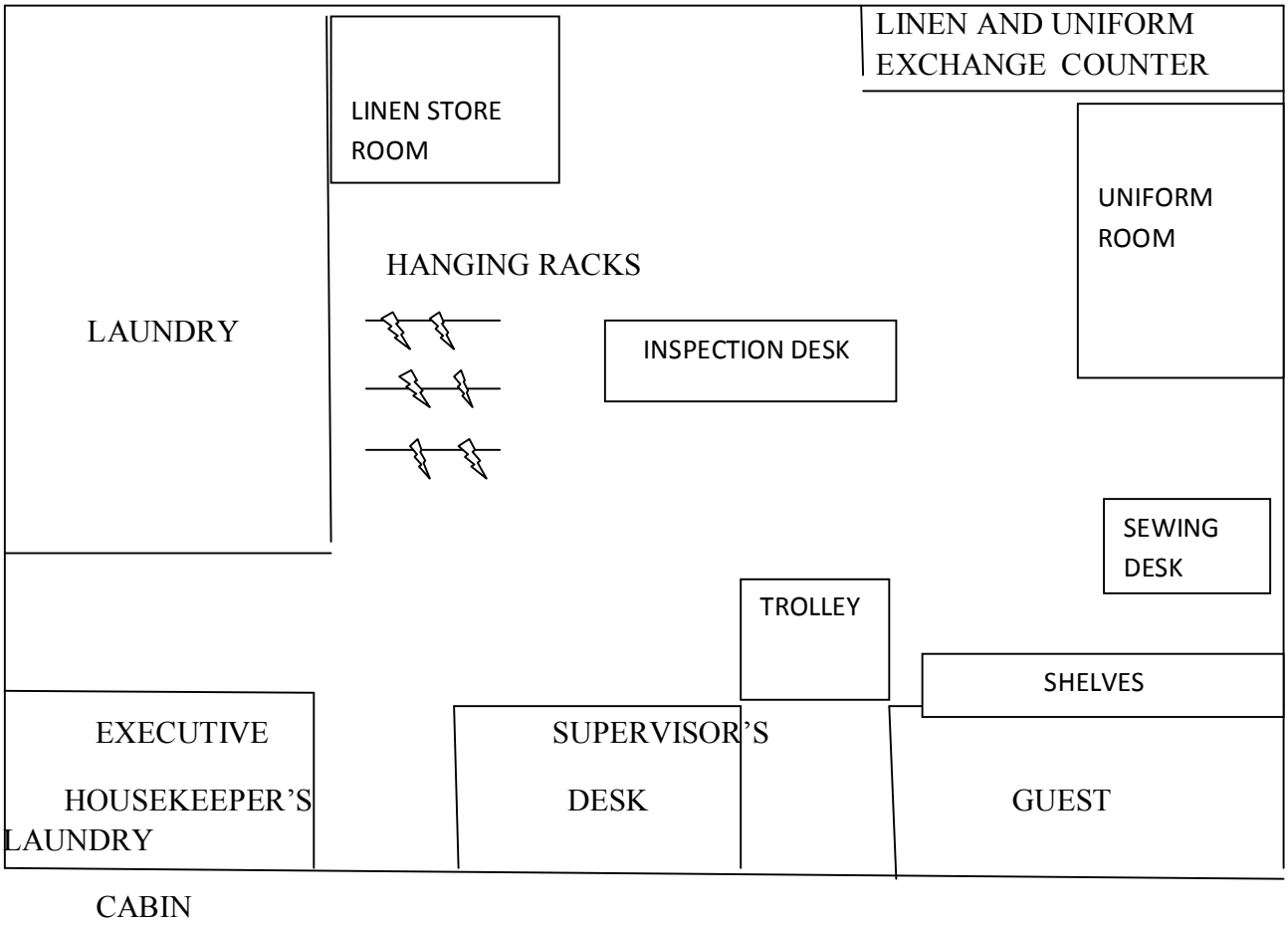
10. STOCKTAKING AND RECORD

Many records are entered on a day to day basis for the exchange of linen between the linen room, laundry and floors/departments. Purchase records are essential and records of condemned linen and makeovers are usually maintained. Periodical stocking is carried out and the annual stocktaking is recorded in the stock register ,thereby providing the value of linen as an assets.

11. SECURITY:

It is important that the access to the linen is restricted so as to prevent misuse and pilferage. Also linen is prone to fire breakouts so precautionary measures are taken to prevent this and the linen room is strictly a non-smoking area,

1.3 Layout of Linen Room



SAMPLE LAYOUT OF LINEN ROOM

LINEN ROOM EQUIPMENT AND AREA REQUIREMENT

- Linen Supervisor's desk
- Shelves for storage of linen
- Cupboard
- Hanging area
- Store room
- Drop counter for exchange of linen
- Linen Trolley
- Soiled Linen Hamper
- Telephone and computer
- Washbasin
- Drying Rack
- Iron and Iron Board
- Carrying baskets
- Work tables (Table top in contrast to white)
- Areas for receiving fresh linen
- Area for collection of soiled linen

1.4 Selection Criteria for Various Linen Item

Criteria which should be kept in mind while selecting linen is as follows:

STRENGTH

The strength of material will depend on the type of fiber used. The type of weave which is used in forming of the fabric also determines the strength of the fabric. The artificial or synthetic fiber like polyester and acrylic are considered to have more strength than the natural one like cotton and wool. The selvedge also provided strength to the fabric.

COMFORT

Fabric should be absorbent when it comes in contact of the body. Cotton material has very high absorbency compared to synthetics. The linen should have softness and light in weight.

LAUNDERING

Linen when washed can be easy processed in less time. Synthetic material takes less time and requires lower temperature and less number of wash cycles than natural fabric. Cotton material develop large amount of creases and takes more time to get ironed.

COLOR

Color adds appeal to the particular area but we should be keep in mind that the color should not fade ,should have a good life span at the same time .Colored fabric should be checked for dye stability. Dark colored fabrics show dust and lighter marks, whereas light colored ones show dirt

and stains more prominently. The color chosen must also be easily available for future use or replacement.

PATTERN AND TEXTURE

Pattern should be such that it can hide marks. Mottled pattern can hide more marks .It should also suit the theme of that area also.

ABSTRACT PATTERN

MOTTLED PATTERN

SHRINKAGE

Synthetics do not shrink, whereas natural fibers shrink about 6-8 percent unless they are treated or sanforised.Wool loses its shape if not carefully laundered.

FLAME RETARDANCY

Wool is naturally flame retardant, synthetic fabric used which is fire retardant is known as Teklan. Flame retardant fabric can be used for drapery, upholstery, and carpets.

THERMAL INSULATION

The difference between two layers and the warmth of a fabric used in blankets is determined by its thermal insulation properties, which is measured in units called ‘togs’. This must be checked for blankets. Curtains also help in maintaining the temperature of a room to some extent.

BED LINEN

BEDSHEETS

1. It should be made up of non- crease fabric, comfortable, easy to be laundered and retain its appearance.
2. The fabric should not lose color in repeated washes or give a faded appearance after wash.

3. Various superior quality blends can be used like linen or union(a blend of cotton and linen)
4. A sheet should be large enough to be tucked in from all sides of mattress.
5. It should not shrink

PILLOWCASES

1. They are generally made up from the same fabric like bed sheets.
2. The size of the pillowcase will depend on the size of the pillow it will be 2 or 4 inches more to allow for shrinkage and a perfect.

BLANKETS

1. It should be soft, smooth and resilient and too heavy.
2. Woolen blankets are easily attacked by insects, so preferably blankets are made up blend of wool and synthetic fiber.
3. Electric blankets are not used as they are difficult to maintain.

DUVETS

1. Duvet are fast replacing blanket in hotels.
2. It consist of a fabric case with has a filling of duck/goose down, a feather mix or a combination of two.
3. Duvet can also have synthetic filling which are usually polyester fibres. These duvets are usually light in weight so it can be easily laundered.
4. Duvet is accompanied by duvet cover which covers the duvet completely.
5. Duvet cover should be soft and easy in laundering usually made up of cotton or cotton blend.

BEDSPREAD/BEDCOVER

1. The bedspread cover the overall bed,. It is available in various color ,pattern and size.
2. The fabric should be drape well and not crease easily.
3. The fabric should be durable and easy for laundering and constant use.
4. The color chosen should match the theme of the room.


CURTAINS/DRAPERIES

1. Curtains are used to block the intensity of sunlight during the daytime to ensure privacy.
2. It should be made of material which do not get soiled easily or collect dust, washable, resistant to sunlight, flame retardant, abrasion resistance and should possess the quality of drapability.
3. Fabrics used can be of glass fiber, wool and acrylic as these are fire retardant.
4. Silk can also be used but it is expensive and is mostly used in luxury hotels.
5. Curtains are available in different types according to the requirement-heavy curtains which has a black lining behind so that in case used during the day time complete blackout can be achieved in the room. Second type is Net, Sheer, or a lace curtain which provides enough privacy during the day while allowing sunlight to filter in, but at night this is not sufficient, heavy curtains are needed both for privacy and for keeping streetlights away.


HEAVY CURTAINS


SHEER CURTAINS

CUSHION COVERS AND UPHOLSTERY

1. The cushion fabric used should not soil easily, non slippery and easily washable.

2. Upholstery fabric should be strong, resistant to soiling, closely woven, resistant to snagging, and should not have static property.
3. In most cases the fabric has a jute backing.

BATH LINEN

1. Bath linen comprise of bath towels, bath sheets, hand towel, face towel, bathmats, shower curtains etc.
2. The fabric should be absorbent, soft and durable
3. Material used should be cotton or linen, huckaback weave is most suitable.
4. The pile type used is uncut pile as it has more area of absorbency.
5. The selvedge for toweling should be firmly woven.

SHOWER CURTAINS

1. The fabric used includes nylon, vinyl, fiberglass, or PVC- coated.
2. The material used should be water resistance.
3. Fiberglass curtains are very brittle but do not attract soil, fire resistant, acid, rot, absorption, shrinkage, attack by insects. They should never be wrung, as the fibers may then break.

TABLE LINEN

1. These include underlays, table cloth, slip cloth, napery, shirts, frills and runners, waiter's cloth etc.

2. TABLE CLOTH-It should be stain resistance, color fastening, easily laundered. it is generally made up of linen, polycot, linen –cotton damask. The size of the tablecloth must be sufficiently large to hang 9 inches below the table edge. Some percentage for shrinkage should also be taken into consideration.
3. SLIP CLOTH-These are placed over the tablecloth to give a contrasting effect.
4. UNDERLAYS-Baize or any other felted material used ,it generally keeps the elbow of the guest comfortable and is sound proofing when crockery and cutlery is used. Molten is a cheaper alternative.
5. SKIRTS, FRILLS AND RUNNERS-These are generally used in banquet halls. It should be stain resistance with the quality of drapability. Satins made of synthetic fibers are used as they are durable and colorfast.
6. WAITER'S CLOTH- material used is generally 100% casement or damask as it is more durable, absorbent.

1.5 Purchase of Linen

Purchase of linen is usually done by the purchase department and the requirement is made by the housekeeping department. There are mainly three areas which should be looked properly.

1. QUANTITY
2. QUALITY
3. SIZE

1. QUANTITY: The quantity of linen would depend on many factors as follows:
   - Size of the hotel or property
   - Standard the hotel wants to maintain for the guest
   - Occupancy percentage of the hotel
   - In-house or contracted laundry facility
   - Number of staff employed.
   - Storage space

   Generally every hotel should keep three set of linen to complete one cycle of operations.

   Linen is a type of non-recycled inventory and is measured with two references:-

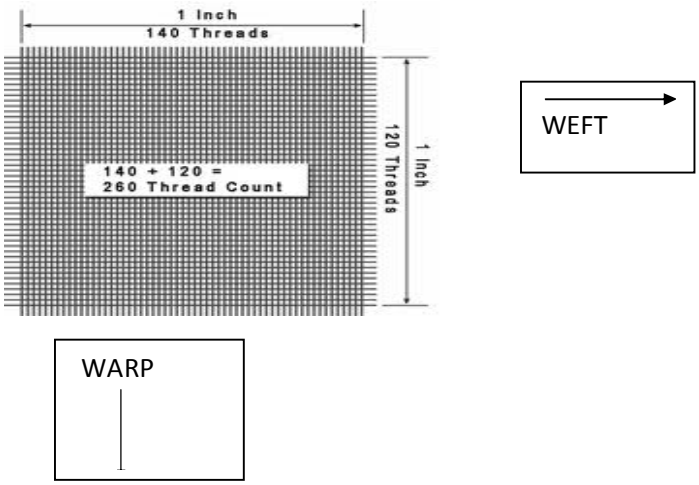
   a) PAR-It refers to standard quantity or number of each inventoried item that must be on hand to support daily, routine housekeeping operations. The inventory levels for recycled items are measured in terms of a par number.
   b) PAR NUMBER-It is a multiple of the standard quantity of a particular inventory item that must be on hand to support day to day housekeeping functions.

QUALITY

The purchase of the linen should have value for money and the best quality linen should to made available within the given budget and following factors to looked into:

- Selection of correct or good quality fabric.
- Thread count of the yarn.

Thread count: The total number of warps and wefts in 1square inch of fabric. The fabric is considered to be of good quality linen if its thread count is above 150. The balance between warp and weft is also important. The warp should be higher and weft should be no more than ten less. This is required for stretch recovery when ironing task is performed on the fabric.



YARN (DIAGRAM)

- Color fastness
- Reputed manufacturers-where the linen item samples can be provided to the hotel for proper testing and assurance of the material.

SIZE

Purchasing linen should be of right size can affect appearance and even hamper operations.

TYPES AND SIZES OF BED LINEN

BED LINEN	TYPES	SIZE (inches)	SIZE (cm)
SHEETS	SMALL SINGLE STANDARD SINGLE DOUBLE QUEEN SIZE KING SIZE	72X108 80X117 90X108 108X117 117X126	180X270 203X295 225X270 270X295 295X315
CRINKLE SHEETS	SINGLE DOUBLE	72X108 90X108	108X270 225X270
PILLOWCASES	STANDARD KING SIZE	20X30 20X36	50X75 50X90
BLANKETS	SINGLE DOUBLE GREEN-SIZE	70X100 90X100 100X117	175X250 225X250 250X295
DUVET COVERS	SINGLE DOUBLE	55X80 70X75	135X200 175X190
BEDSPREADS	Varies with bed spreads or may be fitted spreads.		

MATTRESS PROTECTORS	Single or double, according to bed		
BATH LINEN	BATH SHEET	40X70	100X175
	BATH TOWEL	30X54	75X135
	FACE TOWEL	20X40	50X100
	HAND TOWEL	15X24	38X60
	WASH CLOTH	12X12	30X30
	BATH MATS	24X36	60X90

IMPORTANT POINTS TO BE CONDSIDERED FOR LINEN PURCHASE

1. Estimate for the purchase of linen should be accurate so that the items are not purchased in excess.
2. Accurate specifications must be provided when placing orders, especially with sizes.
3. Take samples of linen and test for amount of 'dressing' that falls out from the fabric when rubbed together.
4. Also check the samples for laundering effects like shrinkage, loss of shape, colour.
5. Large orders should be marked or monogrammed by the supplier.
6. The stitching of material should be strong with firm smooth weave and strong selvedge.
7. Orders should be placed well in advance so that specifications may be met with the requirement.
8. Storage space should be checked foe quantity order.
9. A Purchase Index Card must be maintained for every linen item in stock.
10. A good rapport with the supplier is essential with regard to credit facilities.
11. Mode of transport should be checked with the supplier.\
12. In case the quality of the linen is not accurate ,proper dealing of replacement of linen with no extra payment should be the part of contract.
13. Select a supplier on the same level as your establishment preferably with a recommendation.

PURCHASE INDEX CARD

ARTICLE NAME……

SPECIFICATION ……..

SUPPLIER'S NAME……..

ADDRESS…….MOBILE NO./TEL NO.

Date Received	Amount Received	Unit Cost	Date Issued	Amount Issued	Date Condemned	Amount Condemned	Stock	.Sign,

REMARKS…….

The purpose of a PURCHASE INDEX CARD is to:

- Indicate purchases between previous and current inventory.
- It can be viewed as a reference for ordering , also indicating the level of safety stock.
- Provides a record of condemned articles.
- Provides a means of judging the life span of linen articles.

1.6 Calculation of Linen Requirements

As mentioned above it is essential for a hotel to keep minimum of three par of linen articles for smooth functioning of hotel operations.

Let us understand with a help of an example:

SAMPLE LINEN CALCULATION WORKSHEET

Specification of the Hotel

- Total number of rooms is 100 (50 double room + 50 twin room)
- Maximum house guest is 200
- Linen distribution per room

- Par number considered in 4 b

BED LINEN
1 Bedsheet per bed
1 Duvet cover per bed
1 Duvet per bed
2 Pillows with Pillow cover per bed
1 Bed throw per bed

BATH LINEN
1 Bath towel per guest
1Hand towel per guest
2 Face towel per guest

ARTICLE	ROOM TYPE	NO.OF BEDS/GUEST	QUANTITY	TOTAL	4 TIMES (x PAR)	TOTAL LINEN
BEDSHEET	D.ROOM TW.ROOM	50 100	50x1 100x1	50 100	50x4 100x4	200 400
DUVET COVER	D.ROOM TW.ROOM	50 100	50x1 100x1	50 100	50x4 100x4	200 400
DUVET	D.ROOM TW.ROOM	50 100	50x1 100x1	50 100	50x4 100x4	200 400
PILLOW WITH COVER	D.ROOM TW.ROOM	50 100	50x4 50x4	200 200	200x4 200x4	800 800
BED THROW	D.ROOM TW.ROOM	50 100	50x1 100x1	50 100	50x4 100x4	100 400
BATH TOWEL	D.ROOM TW.ROOM	2 guest 2 guest	2(guest)x1(quantity)x50(rooms) 2(guest)x1(quantity)x50(rooms)	100 100	100x4 100x4	400 400
HAND TOWEL	D.ROOM TW.ROOM	2 guest 2 guest	2(guest)x1(quantity)x50(rooms) 2(guest)x1(quantity)x50(rooms)	100 100	100x4 100x4	400 400
FACE TOWEL	D.ROOM TW.ROOM	2 guest 2 guest	2(guest)x1(quantity)x50(rooms) 2(guest)x1(quantity)x50(rooms)	100 100	100x4 100x4	400 400

JUSTIFICATION FOR 4 PAR

1. One Par in Beds/Bathroom
2. One Par in Linen Room
3. One Par in Laundry (Dirty)
4. One Par in Floor Pantry (Dirty)

1.7 Linen Control Procedures And Records

Control of linen is an important task to manage the operations, it basically falls into three areas of activities:-

1) Hygienic standards and appearance of linen
2) Daily routine exchange of linen between floors and departments linen room and laundry.
3) Purchase details, inventories and stock taking records

CHECKLIST TO REDUCE LINEN DAMAGE

1. Dropping large bundles of linen down the chute causes damage by abrasion against the sides of chute.
2. Knifes and pointed tools should not be whipped with table cloth or waiter's cloth it can damage the cloth fiber
3. Careful handling of linen is required when stripping out from the bed.
4. All the dusters should be coded properly for specific area use; adequate dusters should be given to the staff for cleaning.
5. Hotel should provide tissues and shoe shine pads in the guest rooms.
6. Control the use of excessive bleach in the laundry process as it weakens the fabric, check and supervise the laundry is on-premises.
7. Insufficient stock and poor rotation of linen shortens the life span of the linen article as it does not have rest period.
8. Adequate inspection should be given to torn articles which should be mended immediately.
9. Stained articles should be treated immediately.
10. Care must be taken on reserve stock to ensure that it does not develop marked folds or is attacked by pests.
11. Frequent inspection of laundry baskets bins and trolleys, chutes as well as storage spaces to detect protruding nails or sharp edges/splinters.
12. Sufficient care of damp area for linen causes mildew (black spots on cloth) thus causing eventual tear and spoilage of linen.

1.8 Stocktaking Procedures And Records

1. Stocktaking is the physical inventory of the linen.
2. Taking of inventory for each article is carried out at periodic intervals or at the time of 'closing of books'.
3. Exact entry for inventory is recorded so that the overages and shortages can be determined from the difference between the physical count of balances and the balances appearing in the account inventory ledger.
4. Physical counting is done in three months.

5. The discards are stamped ‘condemned’ and kept separately.
6. Now the counted total inventory must be conducted in the presence of housekeeper.
7. Stocktaking for uniforms, restaurant linen can be done on a separate days.

1.9 LINEN HIRE

Hiring linen is not popular in India but many hotels in other parts of the world do not purchase linen, they are comfortable in hiring laundered linen. Thus, it is a contract with a company which provides laundered linen on rent.

ADVANTAGES

1) Purchase of initial investment for linen articles is eliminated.
2) Laundering of linen is not required.
3) No storage space is required.
4) No appointment of staff required which means saving in paying salaries.
5) Purchase function is eliminated as there is no need to order line.
6) Repairing of linen is not the responsibility of the hotel.
7) Linen hire charges may not be greater than the combined depreciation and laundering costs.

DISADVANTAGES

1) Individuality is not maintained as it is the owned linen of the hotel.
2) There is always limitation for the choice of linen.
3) Linen cannot be cut down or reused.
4) Any damages or large permanent stain is to be paid for usually at higher rate.
5) The hotel is completely dependent on the hiring company.
6) Hotel does not have any control on the quality of the linen.

LINEN STOCK REGISTER

DATE……..

					PHYSICAL STOCK				DIFFERENCE						
Prestock B/F	Add Newstock	Total	Less condemned	Total	In circulation	In linen room	In Laundry	Total	More	Less	Make over	Stock To C/F	Cost Per Item		

AMOUNT……. SIGN EHK …….

7) Linen flow may get affected by the bad weather or strikes causing a breakdown in operations.
8) There is loss of linen which remains unused during low occupancy but the charges fot that period of time needs to be paid.
9) In case of excess requirement it is charged at the current rates.
10) Guest requirement for laundering cannot be fulfilled immediately as the laundry is not in-house.
11) Linen hire charges may not be greater than the combined depreciation and laundering costs.

1.10 Recycling of Discarded Linen

Discarded or condemned linen are items that are no longer useful in their present condition due to some irreversible damage such as a permanent stain or simply wear and tear.

'Cutting Down' refers to the using of any discarded material for some other purpose examples:-

- Bedsheets can be used as dust sheets , double bedsheet to single bedsheet, pillowcover.
- Simplest way is to discard into rags and dusters with marking of condemned linen so that the purpose of the linen is clear.
- Bath towels or bath sheets can be cut down into small toweling dusters.
- Large discard sheets can be cut down for use as crib sheets, aprons etc.
- Discarded linen is sold to hotel staff at reasonable prices.
- Donate to charities.

All discards should be recorded properly for different references like inventory control.

LINEN DISCARD RECORD

Sign of EHK…….

Sign of GM…….. Period ending……

DATE	BATH TOWEL	HAND TOWEL	FACE TOWEL	BATH MAT	DOUBLE SHEET	SINGLE SHEET	REMARKS

1.11 Summary

Linen Management in hotel involves lot of planning in a hotel. The successful operations depend on large extent on par stock maintained by housekeeping department. Standard sizes of linen are used in the hotel ,as linen purchase involves lot of finance there are certain selection criteria which needs to be followed with rules to ensure the right type of purchase. Proper records need to be maintained for linen control and recycling of discarded linen.

1.12 Review Questions

Q1. Discuss the activities performed in a linen room?

Q2.What all will be the part of for a linen room in a hotel?

Q3.What are the selection criteria for various linen item?

Q4.Write down the rules which are followed to be considered for linen purchase?

Q5.What is the importance of Purchase Index Card?

Q6.How is the linen controlled in a hotel?

Q7.What are the various linen room equipment used in a hotel?

Q8.What are the various advantage and disadvantage of Linen Hire?

Q9.What do you understand by recycling of discarded linen?

Q10.Draw the diagram of yarn and label its different section

1.13 KEY WORDS

CUTTING DOWN- This refers to using any discarded materials for some other purpose, such as bedsheets being used as dust sheets or being made into pillow covers.

LINEN-It is a textile made up from flax plant. Linen in hotel is used widely in rooms and restaurants example bath towels, hand towels, table cloth etc.

LINEN CHUTE- A sloping channel or slide for conveying soiled linen from the upper floors to the laundry, usually situated on the ground floor or in the basement.

PAR NUMBER-A multiple of the 'one par 'set-up quantity of stock required to support daily housekeeping functions.

INVENTORY- Stocks of purchased operating supplies, equipments, and other items held for future use in operations.

1.14 REFERENCES AND FURTHER STUDIES

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2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
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4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
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UNIT 2

UNIFORMS AND SEWING ROOM

STRUCTURE

2.0 Objectives

1. Points to be considered while designing of uniforms.

2. What are the advantages of providing uniforms.

3. Issuing and exchange procedure for uniforms in a hotel.

4. Various activities in sewing room.

5. Activities performed by seamstress/tailor.

6. Tools and equipments used by a seamstress in a sewing room.

2.1 Introduction

Uniforms are a type of attire worn by employees of the company or organization such as in army sector, police, navy, doctors, hotels, security guards etc. Uniforms is standardized or identical and is generally specified by the organization, lot of time is spend in designing of uniforms as various factors has to take into consideration In Hotels concept of uniforms is extremely

prominent and starting from the budget available to the comfort levels all angles are covered. Hotels has various departments each of which has their individual role to play ,so generally according to the job roles uniforms differ from one department to the other. Uniforms in hotel

are usually dealt by housekeeping department for its care and maintenance. The budget for uniform is also issued to housekeeping department which does all the uniform planning for various other departments.

Uniforms designing are done by experts as it showcases the image of an organization. There are various types of uniform designed with the use of different material and pattern which matches with the theme of the hotel.

Uniform upkeep involves laundering as per the requirement of the material. Uniform section appoints staff to handle the daily requirement of the staff according to procedures prescribed for issuing and exchange as per the par levels decided by the department for the smooth functioning and availability to each employee or staff. Uniforms provided by the organization is not charged to the employees, else it is the responsibility of the hotel to provide them the uniform.

2.1 Designing of Uniform

Uniforms are a large investment and the cost does not end with purchase. Maintenance and replacement also have to be considered. Various fabrics are used and chosen according to the budget and requirement of the department. Most popular choice for uniforms are terrycots which is a blend of both natural and synthetic cotton and is economical for stitching of uniforms. Drill which is cotton is used mostly for chef's coat and aprons as it is cool, durable, and easy to maintain.

POINTS TO BE CONSIDERED WHILE DESIGNING OF UNIFORMS

(a) IMAGE AND REPUTATION OF THE PROPERTY

If the hotel wants to create a desirable impression on the guest, the uniform should be chosen and designed carefully with all accessories. Many hotels liaison with the designer to get a impressive uniform which is embroidered, customize, unique, attractive and represents the hotel brand. The uniform should also match with the décor and the theme of the hotel ,thereby reinforcing the image of the property.

(b) PROFILE OF THE EMPLOYEES

The cultural background, age, gender of the hotel staff should be kept in mind along with hotel's ethos and the employees work profile. Some hotels even involve the staff concerned while designing their uniforms; it makes the working environment more inductive for the staff as they are comfortable in performing their duties and task.

(c) PURPOSE OF WORK

Designing of uniform should consider the job role of the employee; so that the employee can comfortably work wearing that uniform .Pockets is an important part of designing. A pair of dungarees must have several pockets for the maintenance/engineering employees to keep tools handy. A steward must have pockets that are enough space to keep a pen, lighter, docket etc. shoes chosen for the cooks and housekeeping staff must be skid-proof. Short sleeves are more comfortable for front office staff .Some uniform accessories such as the headwear of kitchen staff, also fulfill an important hygiene function in addition to making their work easier.

Fig (i)

Fig (ii)

Fig(i) Housekeeping uniform which is loosely fitted so that the body movement is comfortable.

Fig(ii)Front Office uniform is well fitted and is accessorized with bow and vest coat to reflect complete professionalism

(d) COMFORTABLE IN WEARING

Hotel staff is especially involved in lot of work operationally and continuously has to be active with lot of physical movements. Uniform with involves labor has to designed with the suitable quality linen and is well fitted. The fit of the uniform should be such that it does not bind or restrict movement.

Fig (iii) Chef uniform which is white in color and is made up of fabric which allows proper absorption.

(e) APPEARANCE AND STYLE

Uniform color and design should be such that it suits all personality and equally looks good on the tall and short, stout and thin. Well- made garments use fabrics that are designed for heavy wear, and their workmanship must support that. This way they will stay bright and looking through countless launderings .the accessories or head gear should be stylish but at the same time, should fulfill all other criterion.

(f) CLIMATIC CONDITIONS OF THE PLACE

These must be considered especially if the hotel is not equipped with the function of centrally air-conditioned. A full sleeve shirt with a tie and waist coat for a steward in humid area will not serve the purpose of working comfortably; similarly a short sleeve cotton gown for a hostess in a cold area will not allow her to work effectively.

(g) BUDGET

Uniform stitching and maintenance involves lot of investment so uniform that look good, are comfortable, and maintain their appearance through laundry cycles are more economical than cheap fabric that do not perform or last. Blends are easier and cheaper to maintain; however blends are not recommend for employees working in humid or greasy areas as grease and perspiration stains easily.

(h) QUALITY OF FABRIC

Fabric selection is also a critical factor to consider when purchasing material for uniforms. Cotton outfits are preferred as uniforms because they are absorbent than polyester and cotton blends. However, blends with cotton are increasing in popularity because they have better soil-release qualities in general and the same time retain some coolness.

(i) EASE OF AVAILABILITYN OF MATERIAL

The fabric and the accessories chosen for the uniforms must be readily available whenever new uniforms are required.

(j) STAFF TURNOVER

This is another area which requires attention .Free-size uniforms can be used in high turnover areas to address this. Trousers or skirts can have elasticized waistbands to accommodate different size.

2.3 Advantages of Providing Uniforms

TO THE COMPANY

(a) WELL GROOMED APPREANCE
The company is successful in displaying a well groomed staff to the guest all times. As the overall upkeep of the uniform is taken by the hotel there is a standardization and uniformity. The guest is happy to interact with staff that are presentable and maintain proper hygienic standards.

(b) IDENTIFY HOTEL STAFF
Uniform allows the guest to recognize the hotel staff and ask for service accordingly, it serve as a security function also as unwanted people can be checked upon entering into back area. Guest Complaints can be managed appropriately as guest knows whom to approach.

(c) DIFFERENTIATE VARIOUS DEPARTMENT
Each department almost has a different style of uniform according to their requirement. This gives a variety to the overall appearance of the hotel and the guest and the staff can easily identity the department of that particular employee and deal with any requirement at a given situation.

(d) WORK COMFORT
When employees are comfortable and at ease they can perform their work with their best of ability. The performance criterion will automatically increase and the hotel will in turn have satisfied staff with guest.

(e) FEELING OF BELONGINGNESS
When the staff is in uniform or the outfit which is same they develop a sense of belongingness which results in higher work performance.

(f) SPIRIT OF TEAM WORK

Employees within the department or in the hotel also build up the team work spirit with the presence of uniform which the hotel an cash continuously for its development.

TO THE STAFF

(a) PROTECTIVE

Uniforms are designed keeping in mind all the safety aspect and considering the nature of work, for example: housekeeping uniform staff is always provided with the antiskid shoes as they also work in area which is wet.

(b) PRESTIGE

When staff wears the uniform he/she is associated with the image of the hotel which serves as factor of prestige

(c) ECONOMICAL

Employee does not have to purchase clothes from its own account so it allows the employee to save money in that particular area.

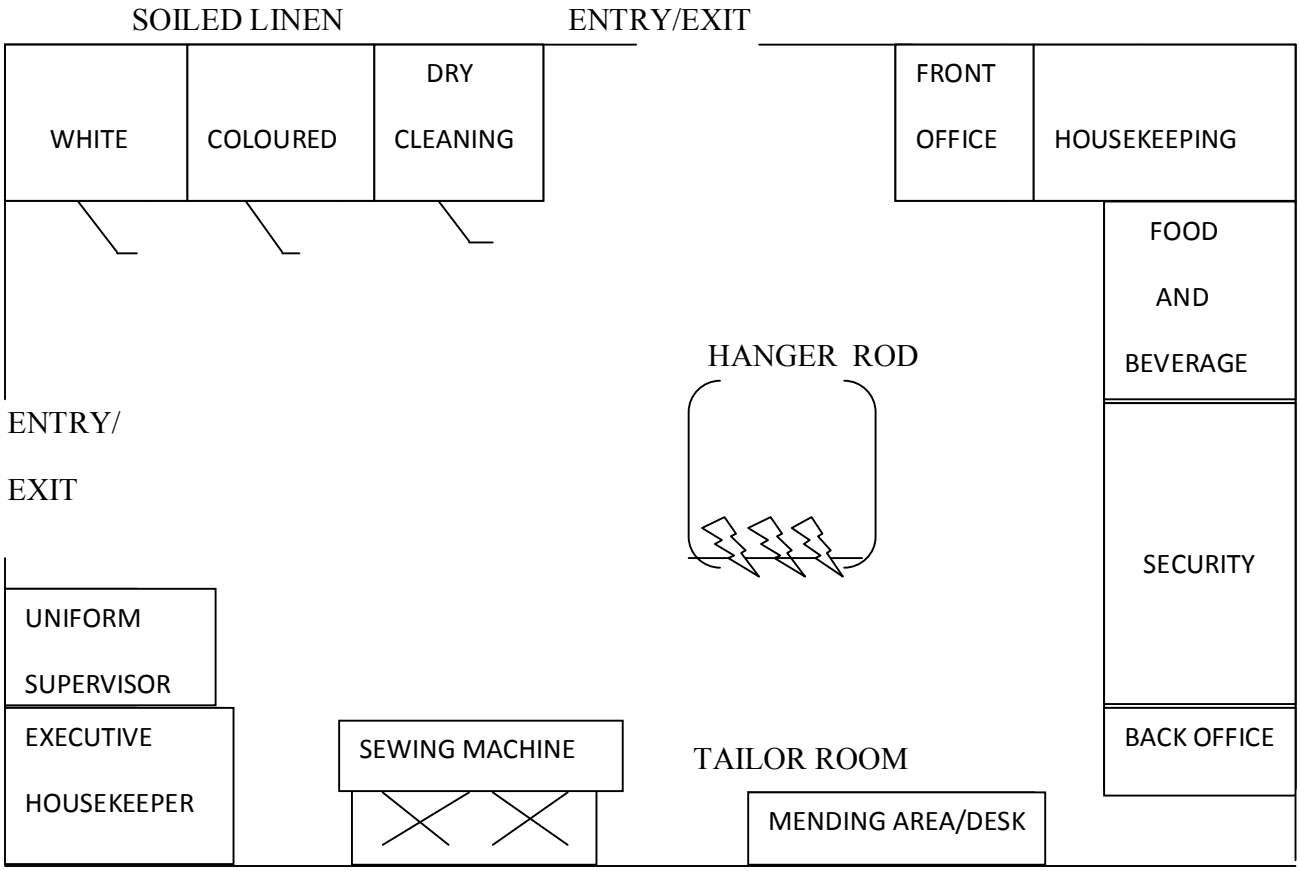
2.4 Layout of Uniform Room

CODING OF UNIFORMS

In Hotel the staff count is generally high and there are various department like Front Office, Housekeeping, Food and Beverage, kitchen, security etc. so when uniform is issued to employee ,all of them are given code which is marked on their uniform and after washing of uniform are arranged department wise. This procedure is usually used in all five star category hotels.

TEMPERATURE CONDITIONS

The temperature should be between 18-23 degrees. Celsius and humidity level should not increase 3%, otherwise the uniform will absorb moisture and will result in spoiling of the uniform.



2.5 Different Type of Uniforms

HOUSEKEEPING UNIFORM

FRONT OFFICE UNIFORM

ENGINEERING UNIFORM

2.6 Planning Par Levels for Uniforms

There are certain considerations which need to be viewed when planning about budget:-

a. Staff Turnover
b. Seasonal Requirement
c. Life expectancy of the material
d. Anticipated changes in décor or theme of the hotel
e. Laundry requirements

REQUIREMENT OF NUMBER OF SETS FOR STAFF

As a general rule, each staff should be provided with at least 2-3 sets of uniform (if the hotel operates with a in-house laundry).Kitchen staff require at least 4 sets of whites.

UNIFORM MATERIAL

The life span of a uniform is between 1-1.5 years

NATURE OF JOB

The job which involves lot of activity will require may require a change of uniforms more often. For example chef's, engineering, room attendant etc.

FREQUENCY OF LAUNDERING

Depending on how often uniforms are sent to the laundry and whether the laundry is outsourced or contracted would influence the number of sets required.

2.7 Issuing and Exchange of Procedure

ISSUING UNIFORMS TO NEW EMPLOYEES

Whenever a new employee joins the organization the uniform is issued by the uniform area by showing the authorized joining letter to the uniform supervisor provided by the human resource department. He then makes all the required entries in the uniform issue register which is duly signed by the employee for the record. The uniform supervisor then issues the staff the uniform which is coded for identification.

ISSUING UNIFORMS TO REGULAR EMPLOYEES

Uniforms are usually given to employees on a one-for- one basis, one fresh uniform for a soiled one. One leaving the organization, employees has to submit his uniform back and obtain the clearance from the uniform department, failing which the last pay cheque is with held.

UNIFORM EXCHANGE PROCEDURE

1. Employee should ensure that arrive at a stipulated time which is mentioned.
2. Deposit the soiled linen after checking for any left over's in pockets and damage.
3. Issue a fresh uniform strictly on a one-for-one basis, ensuring that it is of the correct size and name or the coding identified for that employee.
4. The uniform supervisor will make out the uniform exchange slip in duplicate only when the employee deposits a soiled uniform and then takes the clean one on the following day.
5. The employee has to produce the uniform slip to claim for uniform
6. The original uniform slip is given to the employee and the duplicate retained in the uniform exchange slip book.
7. If the soiled uniform is found to be damaged such that it can be mended, warn the employees, if the uniform cannot be mended, report the matter to the manager.

SAMPLE PAGE FROM UNIFORM REGISTER

UNIFORM REGISTER				
DATE	TIME RECIEVED	TIME CLEARED	REMARKS	CODE
UNIFORM ROOM SUPERVISOR…….				

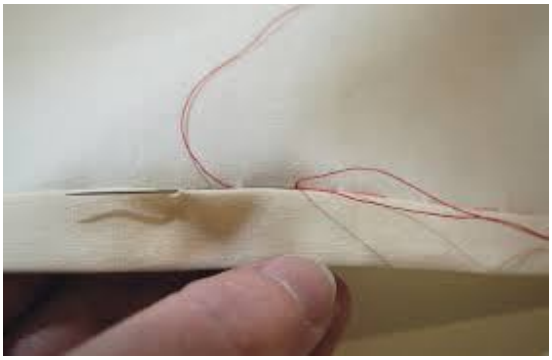
SAMPLE UNIFORM EXCHANGE SLIP

UNIFORM EXCHANGE SLIP		
NO.	DATE	ISSUE NO.
• PANTS…… • COATS…….. • TIE…….. • SHIRT……. • CHEF COAT…… • BLOUSE……		
UNIFORM SUPERVISOR……..... EMPLOYEE……..		

2.8 Activities of Sewing Room

1. Alerting of uniform
2. Patch work on linen
3. Repairing of linen such as bedsheets, cushion covers, curtains
4. Making of pillow cover, single bedsheets, from discarded linen
5. Repairing hems of sheets
6. Mending of guest clothes
7. Stitching Upholstery
8. Making color coded dusters.
9. Monograming
10. Making of mattress cover
11. Repair of frayed parts and tears in towels,table cover,bed linen etc.
12. Stitching of buttons,hooks etc.

REPAIRING HEMS



PATCH WORK

MONOGRAMMING

FRAYED ENDS

2.9 Job Specification of A Seamstress/Tailor

1. Perform skilled and trained task in the making and repairing of articles such as curtains, uniforms, towels etc.
2. Seamstress needs to mend torn linen or articles
3. They have to maintain the cost and production records of stitched article
4. Their job duties may include coordinating with those of linen room attendant or linen room supervisor.
5. They also have to issue linen to Guest Room attendant if required.

2.10 Sewing Area

The sewing room area should have the following:-

1. Good lighting in the sewing room.
2. Space for working table
3. Space for 2-3 sewing machine and ironing board.
4. A pegboard screen for hanging tools, cloths, and storage bags.
5. Storage space for fabrics, pattern, and small equipments.

6. Cupboard for storing accessories.
7. Work surface should be large enough minimum of 2x2 sq meter for cutting and pinning
8. Good quality tools and equipment should be used for easier work completion in sewing room.

PEG BOARD SCREEN

2.11 Tools And Equipment of A Sewing Room

CUTTING TOOLS

- Scissors(10-12 inches)-blunt edges
- Small scissors-sharp pointed edge
- Seam ripper-cuts stitching without harming the fabric
- Pinking shears-It gives a zigzag, fray resistant finish to edges

SCISSORS

SCISSORS WITH SHARP POINTED EDGE

PINKING SHEARS

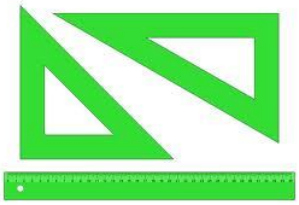
SEAM RIPPER

MEASURING TOOLS

- Fiberglass tape-It can be used in measuring as it does not stretch.
- Meter rule-It is used in measuring of soft furnishings, checking of hem levels.
- Set Square- It is needed when cutting curtains or upholstery to ensure right angles at the corner.
- Perspex ruler-It allows seeing the grains of the fabric.

FIBRE GLASS

METER RULE



SET SQUARE

PERSPEX RULE

PINS AND PIN CUSHIONS

- Sharp pins-18mm long
- Shorter pins- It can be use for lightweight fabrics and paper.
- Glass headed pins-It can be used for sheer or lacy fabrics.
- Longer pins-When cutting out loose covers.
- Pincushions-It keeps pins and needles handy.

PIN CUSHIONS

NEEDLES AND THIMBLE

They are graded by number, ranging from No.1 to No.24 (longest /thick to smallest/finest).

Thimbles are protective covers worn on the thumb and sewing finger when sewing. They should fit the finger well.

THIMBLE

CLIPS AND WEIGHTS

Clips are generally use when a large piece of fabric is being cut. Weights are useful for preventing the material from slipping.

PATTERN PAPER

Pattern paper is available marked with squares to make pattern drawing easy.

MARKING EQUIPMENTS

- Tailor's chalk – It should not be permanent and use in marking alterations.
- Colored carbon paper-It is to transfer to heavier paper.

SEWING MACHINE

Machine should be of commercial use, it should handle various thicknesses of fabric and blind stitch so that the stitching should not show.

SEWING MACHINE

2.12 Summary

Uniform in Hotel hold a very important aspect as it represents a unified feature, build up team spirit and for guest it related to brand image factor. The maintenance of the uniform is taken care by the Housekeeping department where a particular area called the uniform room is formed to deal with the day to day operations. , the staff in the uniform room is skilled and experienced as they have to deal with various situations related to employees of the hotel at the same time. Sewing room forms a crucial part of the uniform section where seamstress is involved in various activities related to mending, repair, monogramming etc, uniform exchange counter is operated for easy exchange of soiled and fresh uniform. Different types of tools and equipments ensure the smooth functioning of the area. Uniform for different departments are designed keeping in mind their job profile.

2.13 Questions

Q1. What are the points to be kept in mind when designing uniform for hotel staff?

Q2. 'The company is successful in displaying a well groomed staff to the guest all times' Discuss the statement?

Q3. Draw the layout of uniform room for a luxury hotel?

Q4.What is the issuing and exchange procedure for uniforms in a hotel?

Q5. Discuss the activities of a sewing room?

Q6.What is the job specification of a seamstress?

Q7. Give details of few tools and equipments used in a sewing room?

Q8. When designing a uniform for a housekeeping staff, what are the important points to be inculcated?

Q9. What are the various documents which are used in uniform exchange procedure?

Q10. How do we plan par levels for uniforms in a hotel?

2.14 Key Words

PAR LEVEL- The standard number of each inventoried item that must be on hand to support daily, routine housekeeping operations.

ALTER-It generally means to change something.

SEAMSTRESS-The person who is responsible for the activities carried out in the sewing room.

PINKING SHEARS- They are scissors the blades of which are saw-toothed instead of straight. They leave a zig –zag pattern instead of a straight edge.

SEAMS-A seam is a method of joining two or more pieces of material together by a row of stitching.

PINCUSHIONS- This is used by a seamstress to keep pins and needles handy.

THIMBLE- Protective covers worn on the thumb and second finger when sewing.

PERSPEX RULE- It allows seeing the grains of the fabric.

PEG BOARD SCREEN- It is a screen for hanging tools, cloths, and storage bags

2.15 References and Further Studies

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
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UNIT 3
LAUNDRY

STRUCTURE

3.1 Introduction

Laundry is the washing of clothing and linens. Laundry processes are often done in a business, room or area in a home or apartment building, reserved for that purpose; this is referred to as a laundry room. The material that is being washed, or has been laundered is also generally referred to as laundry.

Watercourses

Laundry was first done in watercourses, letting the water carry away the materials which could cause stains and smells. Laundry is still done this way in some less industrialized areas and rural regions. Agitation helps remove the dirt, so the laundry is often rubbed, twisted, or slapped against flat rocks. Wooden bats or clubs could be used to help with beating the dirt out. These

were often called washing beetles or bats and could be used by the waterside on a rock (a beetling-stone), on a block (battling-block), or on a board. They were once common across Europe and were also used by settlers in North America. Similar techniques have also been identified in Japan.

When no watercourses were available, laundry was done in water-tight vats or vessels. Sometimes large metal cauldrons were filled with fresh water and heated over a fire; boiling water was even more effective than cold in removing dirt. Wooden or stone scrubbing surfaces set up near a water supply or portable washboards, including factory-made corrugated metal ones, gradually replaced rocks as a surface for loosening soil.

A posser could be used to agitate clothes in a tub.

Once clean, the clothes were wrung out — twisted to remove most of the water. Then they were hung up on poles or clotheslines to air dry, or sometimes just spread out on clean grass.

Washhouses

Before the advent of the washing machine, apart from watercourses, laundry was also done in communal or public washhouses (also called wash-houses or wash houses), especially in rural areas in Europe or the Mediterranean Basin. Water was channelled from a riveror spring and fed into a building or outbuilding built specifically for laundry purposes and often containing two basins - one for washing and the other for rinsing - through which the water was constantly flowing, as well as a stone lip inclined towards the water against which the washers could beat the clothes. Such facilities were much more comfortable than washing in a watercourse because the launderers could work standing up instead of on their knees, and were protected from inclement weather by walls (often) and a roof (with some exceptions). Also, they didn't have to go far, as the facilities were usually at hand in the village or at the edge of a town. These facilities were public and available to all families, and usually used by the entire village. The laundry job was reserved for women, who washed all their family's laundry (or the laundry of others as a paid job). As such, washhouses were an obligatory stop in many women's weekly lives and became a sort of institution or meeting place for women in towns or villages, where they could discuss issues or simply chat, equated by many with gossip, and equatable to the concept of the village pump in English. Indeed, this tradition is reflected in the Catalan idiom "*fer safareig*" (literally, "to do the laundry"), which means to gossip, for instance.

Many of these washhouses are still standing and even filled with water in villages throughout Europe. In cities (in Europe as of the 19th century), public washhouses were also built so that the poorer population, who would otherwise not have access to laundry facilities, could wash their clothes. The aim was to foster hygiene and thus reduce outbreaks of epidemics.

The Industrial Revolution

The Industrial Revolution completely transformed laundry technology.

The mangle (wringer US) was developed in the 19th century — two long rollers in a frame and a crank to revolve them. A laundry-worker took sopping wet clothing and cranked it through the mangle, compressing the cloth and expelling the excess water. The mangle was much quicker than hand twisting. It was a variation on the box mangle used primarily for pressing and smoothing cloth.

Meanwhile 19th century inventors further mechanized the laundry process with various hand-operated washing machines. Most involved turning a handle to move paddles inside a tub. Then some early 20th century machines used an electrically powered agitator to replace tedious hand rubbing against a washboard. Many of these were simply a tub on legs, with a hand-operated mangle on top. Later the mangle too was electrically powered, then replaced by a perforated double tub, which spun out the excess water in a spin cycle.

Laundry drying was also mechanized, with clothes dryers. Dryers were also spinning perforated tubs, but they blew heated air rather than water.

3.2 Laundry and Managing of Premises Laundry

3.2.1 Laundry Work

Laundry is the area or part of housekeeping where linen is washed and pressed. In most hotels, the staff on a contract basis manages laundry. In some hotels it is part of the housekeeping department and at times it is separate department. The laundry receives the soiled linen from the linen room. They are supposed to count and sort out the received linen. The washed and clean linen are handed over to the linen room on one-1o-one basis. All soiled linen received and fresh linen issued should be noted and checked in the linen exchange sheet.

3.2.2 Laundry Process

The laundry procedure includes three basic parts

1. What has to be laundered?
2. What is used in the laundry?

3. How is laundering carried out or what is the laundry process?

1. What has to be laundered?

The items that have to be laundered are classified under three heads, according to the fibres used in the fabrics.

(a) Vegetable fibres - which originate from vegetable forms like cotton, linen, jute etc.

(b) Animal fibres - which originate from animals like wool, silk, fur etc.

(c) Synthetic fibres - which are manmade and originate from fiber prepared by some chemical action like nylon, terelyne, decron, chiffon, etc.

Except for vegetable fibres, all animal or synthetic fibres are safe for dry-cleaning procedure. Some vegetable fibres can be drycleaned but not all.

Fibres used in hotel linen

- Sheets - 100 per cent cotton (polycotton can also be used)
- Pillow cases - 100 per cent cotton (polycotton can also be used)
- Towels, bath mats and face-cloths - 100 per cent cotton. (The looped type towel is called terry or Turkish and it is a smooth huckaback, there is also another type called honeycomb but this is usually used for small hand towels and used in the cloakroom of hotels.)
- Third sheets - 100 per cent cotton, usually seesucker weave. (If they are made of 50 per cent cotton and 50 per cent polyester with a perma-press finish, it is usually called crinkle sheets.
- Blankets - 1 00 per cent wool or wool and nylon or Terylene or acrilan mixtures. (One can have 100 per cent synthetic blankets also).
- Bedspreads - Cotton or cotton and synthetic mixtures are the most usual and practical fibre. However, very luxurious suites may have silk or wool according, to the design.
- Curtains - Heavy drape curtains are generally made from cotton and synthetic mixtures, though again silk or wool can be used in luxury suites.

- Net curtains - Can be made of 100 per cent sheet cotton or more usually nylon.
- Upholstery material - This is for chairs and sofa. Cotton, wool and silk (for luxurious areas) can be used.
- Table linen - Can be made from linen. Linen is a type of fibre which is expensive but extremely hard wearing. It has luster and hence, it is used for table linen. Cotton is more generally used. Both cotton and linen can be mixed with synthetics. Most table linen is made up of damask weave in which loop of long threads can create designs on the fabric. It is generally self-coloured.

2. What is used in the laundry?

(a) **Water:** Water is the most important for the laundry process. It must be available in large quantities in the laundry. Hard water should not be used because the compounds in hardwater react with soap or detergent, which form a thick paste that deposits on the fabric and make the fabric look dull and dirty. Only soft water should be used for the laundering process; if hard water has to be used, it must be chemically treated to free it from compounds before using.

(b) **Soap and detergent:** Soap as a laundry agent is being used from ancient times. In older times, ashes of wood fire under the cooking pot were mixed with leftover fat which was then used for washing clothes. Now-a-days soap is made of fatty acid and alkali combined at different temperature.

A good soap must have the following properties -

(i) It must be easily soluble in water.

(ii) It should be pure.

(iii) It should have good washing power.

(iv) It should be easily rinsed.

(c) **Synthetic detergents:** are used more than the normal soap and detergent as they are easily soluble in any type of water. While rinsing, attention must be given so that no trace of detergent remains in the fabric because they may react with the fibres and damage the

clothes. Clothes should not be dipped in synthetic detergent for a long time as soiling or dirt gets redeposited.

(d) **Alkali:** These are used in the laundering process for different reason but the main reason is to get a better cleaning effect. Alkali gives better results if used with soap and detergent. Alkali and soap are also known as builders. Alkali is added before adding soap or detergent as it helps in converting hard water into soft water. For cotton fabrics, use strong alkali while for wool, silk or similar fabric use mild alkali.

Example:

(i) Sodium Meta Silicate

(ii) Sodium Silicate

(iii) Tri-Sodium Phosphate and Sodium Carbonate.

3.3 Laundry Process

The laundry process includes the following steps:

(a) Receiving, sorting, marking

(b) Washing or dry-cleaning

(c) Hydro extraction

(d) Drying

(e) Ironing

(1) Issuing

(a) Receiving, sorting, marking: When soiled linen is received it includes hotel linen, staff uniforms and guest's clothes. They are at first sorted our according, to the above there types; the second sorting is done according to the items that require - washing, dry-cleaning and repairing. Same items are also sorted according, to the type of fabric as well as degree of soiling. The guest clothes and new staff uniforms are marked by indelible ink on tags' that are attached to the clothes.

(b) Washing or dry-cleaning: The linen or clothes that can be normally washed are sent to the washing machine section and the items to be dry- cleaned are sent to the dry-cleaning section. Washing and dry cleaning processes are not mixed with each other.

(c) Hydro-extraction: It means squeezing out water. Normally washed linen and clothes contain water. This water is removed manually or by the help of machines like hydro-extractor. Delicate garments are mostly squeezed out manually. For effective ironing the wet clothes should be removed when 25 per cent moisture is left.

(d) Drying: Drying can be done both manually and mechanically. Manually means drying by the help of sunlight and air. Mechanically it is done in the dryer with the help of hot air passing through the linen.

(e) Ironing: All the items washed or dry-cleaned require ironing. By calendering machines large clothes or items can be ironed like bed sheets, table cloths, bedspreads, etc. The uniforms, guest clothes or small items are manually pressed by different types of press equipment used for different types of items

(f) Issuing: All linen are issued on one-to-one basis through the linen exchange sheet. Uniforms are issued to the staff after returning soiled ones. Guest clothes are issued through the guest laundry form. Before issuing the laundry, staff must check that all items are properly cleaned and that the items requiring special care has been given special care.

3.4 Hotel Laundry Operation and Laundry Flow chart

The laundry department has a basic cycle of operation with the below steps:-

1. Collecting Soiled Linen.

House maid and room boy should strip linens from beds and areas and put them on to the linen chute or on to the soiled linen carts stored on each floor pantry. Staff should never use any guest linen for any cleaning purpose.

The house boys should go for frequent rounds on each floors to collect the soiled linen from the linen chute or on to each floor pantry. Supervisors should make sure that the soiled linens doesn't pileup on floor pantry which may cause further soil or damage as there are chances that people may walk on them.

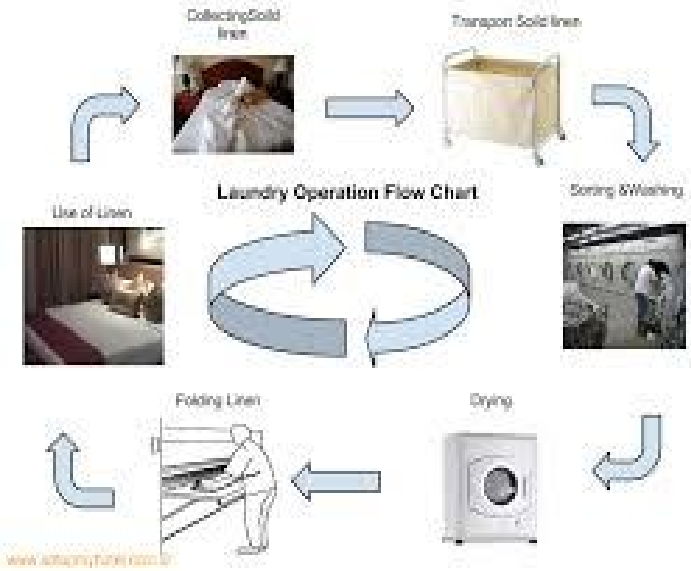
2. Transport Soiled Linen to Laundry department.

The linens form the Laundry chutes and floor pantry are carried to the laundry department by trolley. The housemen should make sure that the laundry items are not dragged on the floor this may further damage or soil the laundry.

3. Sorting of Linen and Uniforms.

The laundry sorting area of the hotel should be large enough to buffer one day worth of laundry and these sorting of laundry should not cause interfere with other laundry activities.

Sort linen and uniforms according to their stains, size, type, color etc.



4. Washing and Dry cleaning.

After the linens and uniforms are sorted properly the laundry staff collects the batches of laundry and load them to the washers. It is also a good process to always weigh the laundry items before loading them to the washers, this will ensure that the washers are not overloaded and help to run them in the optimum operation condition.

If required the soiled linens are treated to remove stains before the washing process. To reduce operational cost nowadays hotels uses chemicals (bleaches, detergents, softeners etc.) while washing process to remove stains instead of treating laundry items separately before washing.

5. Drying.

After the washing cycle is completed the washed items are dried on the dryer. The drying times and temperature vary considerable according to the type type of linen / cloths.

Also always the drying should be followed by a gradual cool down process to prevent the hot linens from being damaged or wrinkled by rapid cooling and healing process.

6. Folding of Linen and Uniforms.

Even though a lot of flooding of linens are now automated, the hotels still do a lot of folding by hand. While folding the linens the laundry attendants should also look for any damages occurred to them while the laundry process.

The folded items are then stored and stacked properly according to batches. The finished laundry items should latest rest for 24hrs. as this will increase their life.

3.5 Laundry Safety

- Power making machines should be equipped or graded to prevent injury to fingers.
- Washing machines and tumblers must be equipped with interlocking devices that will prevent
- the inside cylinder from moving when the other door on the case is open and will also prevent
- the door form being opened while the inside cylinder is in motion.
- Extractors must be equipped with interlocking devices that will prevent the cover from being opened while the basket is in motion, and will also prevent the power operation of the basket while the cover is not fully closed and secured. The device should not prevent the movement of the basket by hand to ensure even loading.
- Power wringers must be equipped with a safety bar or guard across the entire front of the feed or fist rolls.
- Steam pipes that are within seven feet of the floor or working platform and with which the worker may come in contact, must be insulated, covered with heat resistive material, or
- otherwise properly guarded.
- Each power driven machine must be provided with the means for disconnecting it from the source of power .Starting and stopping devices for machines must be located so as to be operable from the front.

3.6 Laundry Team

Laundry Manager:-

He/she is in charge of the laundry and Laundry Manager reports to the Director of housekeeping. He/she is responsible for entire functioning of laundry and dry cleaning unit. He /she should have good knowledge of fabrics and chemicals and laundry machines.

Laundry Supervisor:-

He/she is in charge of the functioning of the laundry in the absence of laundry manager. He must have the knowledge of all the aspects of the laundry equipment, chemicals and fabrics.

Dry cleaner and washers:-

He/ she is in charge of dry cleaning of the hotel linen and guest clothing and washer does the laundering of the linen, uniforms and guest clothing.

Laundry workers:-

They are the staff of laundry who perform following duties;-

i) Spot stained fabrics before loading them into washing machines.

ii) Load soiled linen into washing machines, feed in the right amount of detergent and other laundering chemicals.

iii) Load washed linen into dryers.

iv) Clean equipments after use.

v) Sort soiled linen according to fabric types, colors, degree of soiling.

vi) Transport soiled linen from linen room to laundry and fresh linen from laundry to linen room.

3.7 Laundry Equipment

Equipping a laundry room should be thought out and planned. Make a list of things you will be doing in your laundry room to gather the needed equipment. Storage is important to factor in, as well as the obvious washing machine, dryer, and ironing board. A good supply of detergent, bleach, and fabric softener will need to go on the list as well. Having a basic guide can help get a laundry room set up with the needed equipment.

Washing Machine and Dryer

A good washing machine and dryer will be the basics for the laundry room and equipment. Check out different models and price ranges to see what options fit your needs best. A large family will need a large capacity, heavy-duty option, while a single person living alone can opt for small units. Watch for sales on these large appliances or a package deal for buying the set.

Ironing Supplies
The dreaded task of ironing will need to be addressed as well if you have items that must be routinely ironed. A good quality ironing board and iron will last for a number of years. Spray starch is needed to provide crisp seams. A spray bottle of water to moisten wrinkled items is also useful. A hot pad to put the iron on to cool down will come in handy as well.

Stain Removers
Stains are inevitable and you will need to have supplies on hand to take care of these stains. A pre-treater, stain remover, and a small brush are all great items to have on hand. Place these items in a bucket near the sink, so that they are ready to use when you are in need of removing a stain.

Laundry Baskets and Hangers
No laundry room equipment list will be complete without an ample supply of hangers and laundry baskets. Sturdy plastic hangers are quite inexpensive these days and can be purchased at a variety of retailers. Sturdy laundry baskets are useful for carrying laundry between two locations in the home.

Clotheslines and Supplies
Many people still choose to hang their clothes on a clothesline outdoors. Any hardware or home improvement store will have a good quality clothesline. Wooden and vinyl coated metal clothespins are also available for hanging items. A bag that clips to the clothesline and slides down the line as you move to the next garment is also useful.

3.8 Production Problems

Communication

Like any good business, a laundry's operation depends on good communication. Customers must file their orders in a timely manner. Delivery people and order fillers must keep records of the types and quantities of linens used. Managers must be informed of production difficulties and attitude problems. Any breakdown in communication will hinder the laundry's productivity.

Cross-contamination

Clean linen and soiled linen should never be mixed. For this reason, most laundry facilities have two major work areas, the "soiled area" and the "clean area". These areas are usually separated by a wall. Separate carts are designated for clean and soiled linen. Linen usually passes from the soiled area to the clean area through the washers. Any clean linen that comes into contact with soiled linen or with carts used to transport soiled linen is considered soiled and must be re-washed. Laundry workers who handle soiled linen are required to wash their hands before working with clean linen.

Wet linen storage

Wet or soiled linen that is allowed to sit for an extended period of time may become permanently wrinkled. Worse, wet linen stored in a humid area may mildew, requiring replacement.

Dust

Dust can and does settle on clean linen. For this reason, clean linen left on shelves and in delivery carts should be covered. While many laundries use dust covers specifically made for this purpose, others will improvise, using sheets or blankets.

Cart Space

Every laundry, regardless of size, has a limited amount of cart space for storing linen. For this reason, the laundry's carts must be constantly recycled. The moment a cart is emptied, it is returned to the laundry to be filled with another order. If it is designated for soiled linen, it should be emptied at the laundry facility, then sent back to the collection point for another load.

Replacement linens

Each trip through the wash cycle places wear and tear on the linen. Thus, a major laundry facility needs a constant stream of new linens coming in to replace worn-out items. Items that are not too badly damaged may be set aside for something other than their original purpose. (Permanently stained or torn blankets, for instance, may be used to line floor areas being waxed.) However, they will still need to be replaced in the linen stream.

Maintenance

From its major computerized machines down to the wheels on its carts, every laundry facility depends on mechanical and electric devices. These devices require a range of constant maintenance by skilled and certified technicians. Poorly maintained equipment can limit productivity and may even cause or contribute to injuries.

Rework

As in any business, any job that was not done properly the first time must be redone. Items that weren't thoroughly cleaned must be rewashed. Orders that were filled using the wrong supplies must be re-filled. These are two of the many examples of rework in a laundry.

Overstuffing

In recent years, it has become standard practice in prisons for prisoners to deposit personal laundry in mesh bags. The advantage of this system is that the mesh bags keep personal items separate in large loads during the wash cycle. The disadvantage is that prisoners tend to overstuff the bags. This inhibits mechanical agitation while preventing water and chemicals from reaching soiled linen. The result is poorer quality linen.

Tunnel jams

If tunnel washers have one noteworthy defect, it is the tendency for the tunnel to become blocked when the washer is overloaded. When the tunnel is blocked, the washer must be stopped and allowed to drain, then the blockage must be removed manually. A tunnel jam may cost the laundry several hours of production time. Operators can prevent tunnel jams by paying strict attention to the washer's load limits.

3.9Summary

Laundry is the washing of clothing and linens. Laundry processes are often done in a business, room or area in a home or apartment building, reserved for that purpose; this is referred to as a laundry room. The material that is being washed, or has been laundered is also generally referred to as laundry.

Equipping a laundry room should be thought out and planned. Make a list of things you will be doing in your laundry room to gather the needed equipment. Storage is important to factor in, as well as the obvious washing machine, dryer, and ironing board. A good supply of detergent, bleach, and fabric softener will need to go on the list as well. Having a basic guide can help get a laundry room set up with the needed equipment.

3.10 Review Questions

Q 1. Write a brief history on the laundry evolution.

Q 2. Discuss the laundry cycle.

Q3. What are the production problems faced in laundry?

Q 4. What is the process of laundry? Explain in short.

Q 5. Write a short note on the various equipment used in laundry.

3.11 Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 4

WASHING PROCESS

Structure

4.1 Introduction

From ancient times, chemical additives were recognized for their ability to facilitate the mechanical washing with water. The Italians used a mix of sulfur and water with charcoal to clean cloth. Egyptians added ashes and silicates to soften water. Soaps were the first detergents.

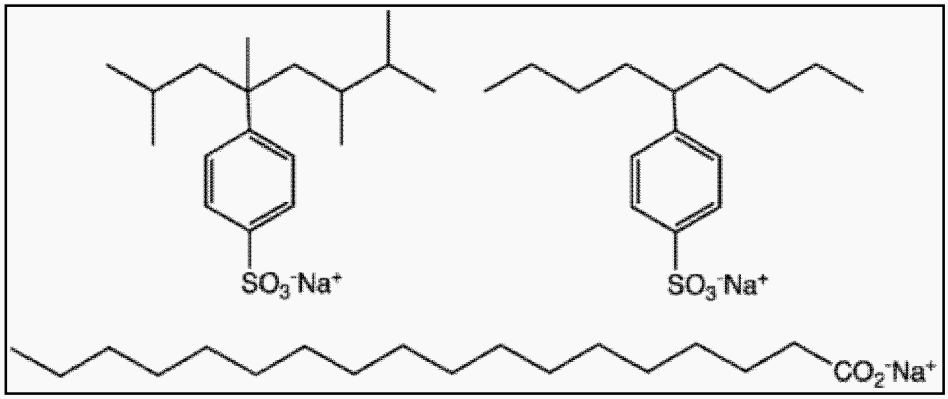
The detergent effects of certain synthetic surfactants were noted in Germany in 1917, in response to shortages of soap during World War I. In the 1930s, commercially viable routes to fatty alcohols were developed, and these new materials were converted to their sulfate esters, key ingredients in the commercially important German brand FEWA, produced by BASF, and Dreft, the US brand produced by Procter and Gamble. Such detergents were mainly used in industry until after World War II. By then, new developments and the later conversion of aviation fuel plants to produce tetrapropylene, used inhousehold detergents, caused a fast growth of domestic use in the late 1940s.

The use of enzymes for laundry was introduced in the early part of the 1900s by Otto Rohm. Only in the latter part of the century with the availability of thermally robust bacterial enzymes did this technology become mainstream.

At the present time, soap has largely been displaced as the main cleaning agent in developed countries. Soap is, by weight, relatively ineffective, and it is highly sensitive to deactivation by hard water. By the 1950s, soap had almost been completely replaced by branched alkylbenzenesulfonates, but these detergents were found to be poorly biodegradable. *Linear* alkylbenzenesulfonates (LABs), however, proved to be both highly effective in cleaning and more biodegradable than the branched relatives. LABs remain the main detergents used domestically. Other detergents that have been developed include the linear *alkyl*sulfonates and olefinsulfonates, which also resist deactivation by hard water. Both remain specialty products, for example only an estimated 60 million kilograms of the sodium alkylsulfonates are produced annually. During the early development of non-soap surfactants as commercial cleaning products, the term *syndet*, short for *synthetic detergent*, was promoted to indicate the distinction from so-called natural soaps.

4.2 Chemistry of detergents

Many kinds of molecules and ions can serve as high-efficiency surfactants. They are often classified according to the charge of the molecule or ion, the three main classes being anionic, neutral, and cationic detergents. Anionic detergents are most commonly encountered for domestic laundry detergents. Detergents are ions or molecules that contain both polar and nonpolar components. The polar component allows the detergent to dissolve in the water, whereas the nonpolar portion solubilizes greasy ("hydrophobic") materials that are the usual target of the cleaning process. An estimated 6 billion kilograms of detergents are produced annually for domestic markets.



Three kinds of anionic detergents: branch alkylbenzenesulfonates, linear alkylbenzenesulfonates, and a soap....

4.2.1 Components

Modern detergent formulations – the entire product vs just the surfactant – contain several components. Three main ingredients are builders (50% by weight, approximately), thealkylbenzenesulfonate surfactant (15%), and bleaches (7%).

Builders

Builders are water softeners. These chemical compounds are agents that remove calcium ions by complexation or precipitation. Typical builders are sodium carbonate, complexation agents, soap, and zeolites. They function by sequestering or precipitating the problematic ions. One of the most common builders is sodium triphosphate, which is used on very large scale for this application.

Bleach

The main targets of bleaches are of vegetable origin and include chlorophyll, anthocyanin dyes, tannins, humic acids, and carotenoid pigments. Most bleaches in laundry detergents are oxidizers, e.g., sodium perborate or sodium hypochlorite. In addition, other agents are added as "bleach activators", to enhance the effectiveness of the bleaching agent; a popular one is tetraacetylethylenediamine.

Enzymes

The amounts of enzyme can be up to about 2% by weight of the product. These agents are required to degrade recalcitrant stains composed of proteins, fats, or carbohydrates. Each type of stain requires a different type of enzyme, i.e., protease for proteins, lipases for greases, and amylases for carbohydrates.

4.2.2 Other ingredients

Many other ingredients are added depending on the specific application. Such additives modify the foaming properties of the product by either stabilizing or counteracting foam. Other ingredients increase or decrease the viscosity of the solution, or solubilize other ingredients. Corrosion inhibitors counteract damage to washing equipment. "Dye transfer inhibitors" prevent dyes from one article from colouring other items. "Antiredeposition agents" are used to prevent fine soil particles from reattaching to the product being cleaned.Carboxymethyl cellulose is used for this purpose.

A number of ingredients affect aesthetic properties of the item to be cleaned or the detergent itself before or during use. These agents include optical brighteners, fabric softeners, and colourants. A variety of perfumes are also components of modern detergents, provided that they are compatible with the other components and do not affect the colour of the cleaned item. The perfumes are typically a mixture of many compounds, a popular component being cyclohexyl salicylate, which is related to oil of wintergreen.

4.3 Washing Process

The washing process includes the following stages in which the first one is compulsory while the last two are optional.

1. Wetting
2. Soil removal
3. Soil suspension
4. Removal of soil
5. Bleaching
6. Blueing

1. **Wetting:** In this stage the clothes are wetted in a detergent solution; this is done to loosen the soiling or dirt. Some fabrics are waterproof, so care should be taken while wetting fabrics like wool and silk.
2. **Soil removal:** In this stage, the loosen dirt is separated. This is the main objective or major step of the washing process. Soil removal is done in this step. The failure of this stage will spoil the whole cleaning process.
3. **Soil suspension:** In this stage, the soiling or dirt is to be prevented from redepositing on the fabric and must be held back in the detergent solution. If redeposition occurs on the fabric then the fabric turns greenish and if it is uneven then it forms black spots known as scum.
4. **Removal of soil:** This stage includes rinsing of the clothes. Rinsing is done to remove the suspended dirt as well as the detergent from clothes. In the washing machine, removal of soil is actually done by diluting the detergent solution in the machine.

5. **Bleaching:** Bleach improves the white colour of white fabrics. Bleaching of an article should be restricted to a minimum and should be done when it is really required.
6. **Blueing:** Blueing is done only to the white linen after wash. White linen becomes yellowish and this can be corrected by applying blue to a fabric. After bleaching, blueing can correct yellowness. Excess of blueing can make a shirt look blueish or even spotted/marked with blue.

4.4 Stain Removal

Definition: Stain is a mark or discolouration caused by the absorption of foreign substance on a textile. Stain removal method aims at treatment and removal of discoloured spot from the fabric.

4.4.1 Identification of a Stain

- **Sight:** By looking carefully at the stain, to identify if it is absorbed or built-up stain.
- **Odour:** To smell the stain, especially after giving it a light steam treatment, you will come to know what type of stain it is.
- **Colour:** It also gives an important clue on the nature of stain and the agents causing it.
- **Feel:** By running your hand/fingers over the stain to feel its stiffness, especially of a built-up stain.
- **Location:** it helps to pinpoint the cause of stain. Perfume stains are usually located on the lapels of garments or under the arms.

4.4.2 Importance of Immediate Action

Stains should be treated immediately so as to prevent them from spreading as well as from being absorbed by the fabric. The action involves sponging or washing the stain with water or mild detergent solution.

4.4.3 General Rules of Stain Removal

1. Always treat the stain immediately.
2. If a stain is not removed after immediate action, then specific removal may be required. Before attempting specific removal, first ascertain the nature of the fabric, the nature of the stain, age of the stain, colour of the fabric, etc.
3. Select appropriate stain removal reagents and methods accordingly. Before attempting stain removal, check the reaction on the fabric and the reagent also.
4. Always start with the mildest method and reagent, gradually progressing to stronger methods and reagents.
5. Stretch the stain over a pad of clean white absorbent cloth with a piece of clean cotton wool, apply the reagent on the stain.

6. Start applying the reagent to the outer edge of the stain and work towards the center. This will prevent the stain from spreading as well as formation of a ring.
7. Sponging is preferable to soaking and rubbing with the reagent.
8. Rubbing and washing instantaneously is preferred to soaking and then washing.
9. Always neutralize the effect of every chemical used by thoroughly rinsing the reagent at each step before attempting the use of another method or reagent.
10. The need of professional help if required should be ascertained at the time of stain removal.

4.4.4 General Rules for Removal of Unknown Stain

1. Soak stain in luke warm salted water for minimum half an hour.
2. If stain persists, wash in luke warm synthetic detergent solution.
3. If stain still persists, wash in luke warm enzyme detergent solution.
4. If stain still persists, use hot synthetic detergent solution to activate sodium perborate, which is an oxidizing bleaching agent.
5. Use solvent on still persisting stains.
6. If stain is not removed work with mild acidic solution progressing towards strong acidic solution.
7. If stain does not go, use alkaline progressing towards strong alkaline solution.
8. If stain still persists, appropriate bleaching treatment should be done.

4.4.5 Important Points to be kept in Mind

1. After every step, thoroughly rinse in water to neutralize the effect of each cleaning agent.
2. Temperature should be adjusted accordingly, keeping in mind the nature of fabric and the stain.
3. Type of chemicals used and the time of application should be according to the nature of the fabric.

4.4.6 Stain Removal Agents

(a) **Organic solvents**

A	B
Benzene, white spirit, turpentine	Carbon tetra chloride, Per chloro ethylene

Both these solvents (A and B) dissolve grease and require care when used.

Group A is inflammable and should not be used near a naked flame.

Group B though not inflammable should be used in ventilated areas as they are harmful when they are inhaled and used for removal of chewing gum stain, grease stain, oil, lipstick, ball point stain, etc.

(b) **Acids**

Oxalic acid, potassium oxalate, salts of lemon acid are frequently used as removers. All these are poisonous and must be carefully handled. Acid must be diluted before using. Some dyes are affected by acid; so acid should be used only on fast colours. Washing with detergent or through rinsing is essential to neutralize excess acid and prevent any damage to the fabric. They are used for removal of metal stain, rust, blood and iron stain, etc.

(c) **Alkalies**

Washing soda, ammonia dyes and animal fibre are adversely affected by alkalies so they should be used only on cotton and linen fabric. Alkalies I are used for removal of old and heavy vegetable stains like tea and coffee.

(d) **Bleaches**

The process of changing a coloured fabric or substance into a colourless one is known as bleaching. As they weaken the fabric, extreme care should be taken while using them. They whiten the coloured substance either by oxidizing or reducing.

Oxidizing bleaches

They liberate oxygen, which combine in colour pigments to form a colourless compound.

(a) Sodium hydrochloride

(b) Hydrogen peroxide

(c) Sodium perborate

(a) Sodium hydrochloride- This is a household bleach which damages animal fibre; it must not be used on silk and woollen articles. It is used for removal of obstinate stain on cotton and linen fabrics, it fIXes iron and rust stains. All articles should be thoroughly rinsed with water.

(b) Hydrogen peroxide- It decomposes readily after adding little ammonia to the solution. It can be used on white fabric.

(c) Sodium perborate- It is a safe and quick acting agent present in powdered soap and soap less detergent.

Reducing bleaches

They remove oxygen or add hydrogen to the coloured substance and make it colourless. Sodium hydro sulphite and some enzymes can be used in white fabrics. This type of bleach is milder in action than oxidizing bleach used for removal of iron stains and stripping of dyes.

Enzymes, e.g., powdered pepsin may be used for the removal of protein stains from the fabric. Fabrics must be treated so as to make them stain repellant. Using chemicals such as scotch guard gives both oil and water protection. Fabrics are made water repellent by the use of silicon.

4.4.7 Classification of Stain Removal Method

1. Physical method
2. Chemical method

1. Physical method

(a) Reagent used, which absorbs the stain from the fabric surface, e.g., Chalk powder, fuller's earth and starch pad.

(b) Use of grease absorbents.

(c) Heat application method used generally on fresh stains.

2. **Chemical method**

The reagents used have stain removal chemical properties.

Basic chemical wash is given. Example: salts, solvents, acids and alkalies.

Some chemicals can be mild. Flammable and toxic ones have to be used with care and not on plastic, vinyl or nylon, e.g., benzene, acetone, CC14, amyl acetate, etc.

These are used for old or stubborn stains, e.g., bleaching method of stain removal.

4.4.8 Classification of Stains

1. Animal stain (e.g., milk, egg, cream, etc. These are generally protein-nacious in nature.)
2. Vegetable stains (e.g., tea, coffee, coco, wine, fruit juice, grass, etc.
3. Mineral stains (e.g., lipstick, nail polish, rust, ink, etc).
4. Fats and oils (e.g., cooking oil, butter, etc).
5. Coloured ink, writing ink stains.
6. Protein stains, blood stains, perspiration stains, egg etc. (Same as animal stains in most cases.)
7. Miscellaneous (e.g., vomit, bird droppings, chewing gum, perfumes, etc.)

Stains may be classified on the basis of the nature of stain or even on the basis of stain removal. Grass and mildew stains are classified under vegetable stains but the method of removal is different.

Grass Stains - It is caused due to the chlorophyll pigment present in grass. Sponge the stain with a detergent solution. If the stain persists, soak in Methylated spirit and then in detergent solution.

Mildew- This is a fungal growth on cotton fabric. It is difficult to remove if the stain becomes old. There are three ways to remove:

1. Wet the surface of the stain, put in strong sunlight and keep dampening the cloth till completely removed.
2. Make a paste of fuller's earth, spread on the area of stain; put in strong sunlight and dampen it till it is removed.
3. Bleach and then soak in mild oxalic acid solution and then finally wash in mild detergent solution.

Animal Stain

- **For washable fabric -** Soak in luke warm water for 11/2 hours. Most often stain gets dissolved. If not wash in warm enzyme detergent (e.g., Ariel). Stain should be treated as soon as possible.
- **For unwashable fabric -** Sponge the area with luke warm water and then with warm detergent solution and if stain persists make a paste of absorbent powder, e.g., chalk powder either in water or in solvent depending on the nature of fabric. Cover the stain with this paste and let it dry, brush at once. The stain can then be sponged with a slightly damp cloth. This is called the poultice method.

1. Blood stain - Soak in luke warm salted water, wash in warm enzyme detergent. Bleach if necessary. Bleach used is sodium hydro sulphite.
2. Milk and egg stain - Same as blood stain, exception to this group.
3. Perspiration stain- It could be acidic or alkaline. Sponge with vinegar or methylated spirit and then wash with detergent solution.

Vegetable Stain

Most of the fresh vegetable stains can be removed by washing and use of a hot detergent solution. If the stain persists, then specific removal methods will be used.

1. For tea, coffee, cocoa, wine, juice - Sponge off the excess stain. For fruit juice and wine - sprinkle salt to prevent stail1 from spreading and it also helps in absorbing the coloured pigment of wine, which will make subsequent stain removal easy. Then soak in hot detergent solution; warm soda solution can also be used. If the stain is on cotton and linen fabric and stain persists, then household bleach should be used.

2. Turmeric - Scrub off excess turmeric, wash in detergent solution and then rinse. Treat in the same way as for tea and coffee. If the stain is on a silk fabric, use diluted hydrogen peroxide and then gently wash the fabric.

Mineral Stain

Caused by salts of metals and may be alkali based. General rules for removing mineral stains are:

- Soak it in mild acidic. (Bleach)
- Wash in warm detergent solution.
- Wash in hot water, then rinse. If the stain has become very old then step 1 and 2 can be repeated.
- Soak in mild oxalic acid.

If the stain is on silk and wool - sponge with respective solvents and then wash.

For blue ink - Blot the excess, rinse with water and wash in detergent solution. Soak in mild oxalic acid and bleach with sodium hydro sulphite.

For red ink - Best results if it is removed as quickly as possible. Soak in methylated spirit or salt of ammonia. Then, soak in mild acidic solution, rinse with water. Bleach with sodium hydro sulphite.

For green /purple/marking ink - Soak in bleach with sodium hydro sulphite. Later, soak in mild oxalic acid. Rinse with water.

For iodine - Wash in water then detergent solution. Rub with a raw cut potato and apply a solution of starch (bare). Wash with sodium thio sulphate.

4.5 Dry-Cleaning

Dry-cleaning is a process where the linen is not washed, i.e., it is not wetted by water as the name suggests. It is cleaned by petrol or spirit. It is called dry- cleaning because during the cleaning process the fibre does not get wet although spirit or petrol is used.

The linen after sorting is marked 'dry-cleaned'. The dry-cleaning solvent is kept (Per Chloro Ethylene) in an enclosed machine in which the washing, extraction and drying are carried out. The solvent is not wasted but distilled and filtered for re-use because of its high cost. These solvents don't affect the fibre, unlike water.

In dry-cleaning there is no danger of shrinkage, severe creasing, distortion or fading. Sometimes to remove water borne soil and stain, a little amount of water and detergent is mixed with the solvent (known as charged systems). After the linen has been cleaned, they are spun to extract the excess solvents and then dried with warm air. They are then hung to remove the smell. Check for stains before pressing. If any special care is required it is done before pressing.

4.5.1 Dry-cleaning waste

Cooked muck

Cooked powder residue is the name for the waste material generated by cooking down or distilling muck. It is a hazardous waste and will contain solvent, powdered filter material (diatomite), carbon, non-volatile residues, lint, dyes, grease, soils, and water. This material should be disposed of in accordance with local law.

Sludge

The waste sludge or solid residue from the still contains solvent, water, soils, carbon, and other non-volatile residues. Still bottoms from chlorinated solvent dry cleaning operations are hazardous wastes. Still bottoms from machines using other solvents may also be hazardous due to toxic constituents in fabric dyes and notions.

Filters

Filters used in perchloroethylene based machines are also regulated hazardous waste in the United States.

Separator water

Water will separate from the dry cleaning solvent, and must be removed. This waste water, from machines using perchloroethylene, is a regulated hazardous waste in India.

4.6 Handling Guest's Laundry

Terminology

- Guests staying in a hotel, frequently request to have their clothes 'laundered' that is the term that is given to washing, pressing and dry- cleaning.
- Dry-cleaning is a method of removing stains with special chemicals rather than washing. Many fabrics would shrink if washed.
- Pressing is similar to ironing. Its purpose is to remove creases.

Lists and Bags

In hotels, which offer this service, lists are left in the bedroom, together with laundry bags.

Usually there is a separate list for each. These may be placed in the closet or in the drawer. Laundry bags are usually made of plastic.

Procedure:

1. Collection:
    - Guests ring up laundry or housekeeping.

- Laundry or room attendants collect from guest.
- Laundry or room attendant should check that the room information given on the list is correct:
  (a) Room number
  (b) Description and number of items
- The list is placed in the laundry bag and taken to the laundry.

2. Return:

   Placed in the closet, on hangers or on a clean surface if folded.

3. Charges:

   Become familiar with the various charges, e.g., if laundry is to be returned within one hour, a surcharge may apply.

   In-house laundry or contract:

   - Laundry can be undertaken either 'in the hotel' or by an outside contractor.
   - The main advantage to the hotel is that it:
     (a) Earns money
     (b) Provides a quick service to guests
   - The main disadvantage is that it is:
     (a) Expensive to set up
     (b) Requires expert technical management

4.7 Valet Service

One of the primary roles of the laundry is to provide valet services to house guests. A valet is one who, on call, fetches soiled clothes from guest rooms and returns them either washed or dry-cleaned as per the guest demands. In hotels that do not have an in-house laundry, it is the Housekeeping Department that provides the valet service. The Housekeeping Control Desk phone number in such a case is listed in the guest room directory of services. It is essential for the housekeeping personnel to know that in a guest room there are two laundry slips distinguished by their different colours-one signifying dry-cleaning requirements while the other washing requirements. As shown in the exhibit (a) and (b) indicate, both forms have similar listings of various common garments that gents and ladies wear. The guest is required to fill the appropriate form and submit it along with the soiled clothes in the laundry bags provided. Sometimes, the valet is required to fill the form in presence of the guest.

For a 'same day' service, the hotel levies an additional charge. If the hotel is unable to provide a 'same day' service, the valet must inform the guest accordingly. The valet must inspect each solid garment of the guest and bring to his notice any tears, stains, etc., that he may like to have attended to.

4.8 Environmental concerns

Early in the introduction of sulfonate-based detergents, concerns were voiced over the low rates of biodegradation of the branched alkylbenzenesulfonates. This problem was addressed by the introduction of linear alkylbenzenesulfonates.

A more profound problem arises from the heavy use of sodium triphosphate, which can comprise up to 50% by weight of detergents. The discharge of soluble phosphates into natural waters has led to problems with eutrophication, or the growth of living things, of lakes and streams, often where it is not desirable. The replacement of sodium triphosphate by zeolites offers some relief to this problem. With respect to the phosphate additives, between 1940 and 1970 "the amount of phosphates in city wastewater increased from 20,000 to 150,000 tons per year. With an increase in phosphates, especially in the absence of species feeding upon algae, algal blooms grow splendidly on the excess phosphorus and can produce toxins, killing fish, dolphins and plants. They can also indirectly cause oxygen depletion at greater depths, through microbial breakdown of dead algal cells.

In 2004, the European Union introduced regulations to require biodegradability in all detergents,and intends to ban phosphates in domestic products from 2013.

Australia began phasing out the use of phosphates in its detergents in 2011, with an all-out ban expected to take effect in 2014.

4.9 Summary

From ancient times, chemical additives were recognized for their ability to facilitate the mechanical washing with water. The Italians used a mix of sulfur and water with charcoal to clean cloth. Egyptians added ashes and silicates to soften water. The washing process includes the following stages in which the first one is compulsory while the last two are optional, Wetting, Soil removal, Soil suspension, Removal of soil, Bleaching, Blueing.

4.10 Review Questions

Q 1. Discuss in details the process of washing.

Q 2. Briefly discuss the various components of the detergents

Q 3 Write a short note on Identification of Stains.

Q 4. What are the general rules of Stain Removal?

Q 5. Write short note on Bleaches.

Q 6. Classify Stains and discuss.

4.11 Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 5

FLOWER ARRANGEMENT

STRUCTURE

5.0 Objectives

1. What is the importance of flower arrangement in hotel.
2. Various type of ingredients use to make flower arrangement.
3. Points to be kept in mind to make the flowers stay for long.
4. Principals of flower arrangement
5. Different styles of flower arrangement.

5.1 Introduction

The art of flower arrangement is as ancient as history of flowers. This is one of the earliest ways to satisfy a person's desire to create beauty. Earlier arrangements were used to be made in temples during festivals. The first rules of ikebana laid over in Japan more than a thousand years ago. Yet, before the 1930s, flower arrangement was considered neither a serious craft with set rules nor a recognized art form in much of the west. After the 1930s, rules and guidelines were formulated for amateur florists, following which the first flower-arranging experts made their appearance on the scene professionally. Now this art is used in hotels, offices, hospitals on an everyday basis. Even at homes and venues of festivities on auspicious occasions, flowers are used in a big way in form of garlands, wall hangings, floor decorations. Flower arrangement has very close relationship with aesthetic (heavenly, celestial, natural) beauty.

For any kind of ceremony/functions flower form an indispensable part of creating beauty and an atmosphere close to nature. The function/ceremonies remain incomplete without flowers.

Flower arrangement doesn't necessarily mean that only blooms and flowers are used but may be made from any type of plant material, shrubs, grass, leaves, fruits and barriers and any type of dried plant materials. Apart from these, artificial material such as ribbon silk, lace, foam, plastic, velvet, feature, drift wood, etc. All these may be specially cut and designed or shaped to resemble or match a flower arrangement and can be kept without any water. Earthenware pots can be used to make arrangement look more natural.

The inherent properties of the flowers and foliage one decides to use, sets the style of an arrangement establishing its dominant color, shape and texture. While traditional flower arranging techniques provide useful guidelines, they should not be considered as rigid rules. It is far more important to express yourself and create a display that sets comfortably on its settings. The presence of flowers can subtly alter the atmosphere of a room, introducing a sense of calm and bringing natural freshness and color indoors.

When starting an arrangement, consider whether the eventual setting of the display calls for a formal, modern or casual theme. Then think of the container you plan to use, and which flowers will enhance its size, shape, color and texture.

Fresh flowers transform a room with its beauty, color and scent. Select stems partly in bud to last longer, and if combining flowers, try to mix varieties of similar longevity. Bold, eye-catching flowers provide the focal point for an arrangement, while less conspicuous blooms act as fillers and recessionary material. Fresh flowers should not be confined to festivals or celebrations.

Almost every arrangement includes foliage, whether on the flowers themselves, or as a separate ingredient. Foliage is used in displays as filler material, or to add textural and color contrast. Stronger, bold pieces can be used to form the outline of an arrangement, while longer, supple foliage adds width and sense of movement.

Dried flowers allow you to create year-round, permanent arrangements, but because many of them are brittle and lack natural movement and suppleness, you must plan the finished display thoroughly before starting to arrange. To compensate for flowers' rigidity, aim to use them in fairly compact displays with a definite outline and avoid single protruding stems. Always handle dried flowers carefully.

Color is the predominant factor in any arrangement, and while the style of display and range of flower forms, play an equal part in the finished piece and color makes the initial impression. It is important to experiment with different tones, and to mix and match shades. Do not be afraid of testing new color combinations – even traditional "clashes" of color can look impressively vibrant.

The container is integral to the design of a flower display, and its size, shape, color and texture all affect the choice of flowers, and determine the final effect. When container and flowers are sympathetic to one another, the display is seen as one object. Clear glass containers almost disappear in a display, making them appropriate for most settings, while colored or textured containers will always have a more significant influence over the choice of flowers and can be linked to their surroundings more emphatically.

5.2 Flower Arrangements in Hotels

In hotels, flowers are used extensively, large arrangements in Foyers, Lounge and Restaurants, etc as well as small arrangements in rooms, suites, etc. Bud vases are kept in every room these days. VIPs may have large arrangements appropriate to the area and the occasion. Pleasing atmosphere is created for weddings, receptions, banquets and conferences. The arrangement suited to the occasion is place. Special arrangements are also made to which flowers are used in hotels interiors depending on the degree of luxury provided, number of functions held and hotel private policy. Housekeeping is responsible for all flower arrangements and their placements arrangements can also be bought or a system of take away by engaging full time/part time florists or contracting out.

Levels of placement

It is evident from this list that the placement of flower arrangements can be categorized into three different and distinct levels.

- ✓ Eye level – 18" to 4' – coffee tables, dressing tables, sideboards, dining tables, T. V tops, alcoves, niches
- ✓ High level – 5' & above – pelmets, wardrobe, fridge, suspended from ceiling
- ✓ Low level – on floor up to 8" – landscapes, driftwood, larger or heavy decorative vases.

5.3 Basic Ingredients of Flower Arrangement

Making up a good flower arrangement requires a lot of creativity on the part of the arranger, and materials used for making flower arrangements. The following groups of ingredients and aids are essential to flower arrangement:

MECHANICS

These are the items used to keep flowers, foliage, twigs in place within the container so that they are stable. These mechanics should not be visible ,otherwise it will spoil the appearance of the flower arrangement.. The various mechanics used in flower arrangement are:

1. PIN HOLDERS OR NEEDLE POINT HOLDERS**:** It is a metal piece with several fine and sharp pins. It has a heavy metal base usually made of stainless steel. They are available in several

sizes which is required for different types of vases. In Japanese it is called as “kenzan”. They are useful for anchoring the stems and thus increase the stability.

2. FLORAL FOAM**:** It is commercially called as oasis. It is used in holding the stems. There are two varieties of oasis which are available, green foam used for fresh flower arrangements and pale brown foam for dry flower arrangements.

3**.** WIRE MESH: Also called chicken wire, it is crumbled, packed wire mesh used for holding stems. The wire mesh generally covers the foam completely and to hold the same we can use stub wire to lock it from the ends.

4. FLORIST’S CONE: This is also called a ‘flower tube’ or ‘flower funnel’. It acts like a miniature vase used in large arrangements, where foliage or flowers need to be placed above their stem height. The pointed end is tied to the stem to position flower at the required angle.

5. BEESWAX: Placed below the pin holders so as to hold them in place.

6. STUB WIRE: Are useful for supporting flowers whose stem might become curved as they take up water or for joining the ends of wire mesh when we place it on the oasis.

7. PRONG: This is the simplest type of floral foam anchor. It is a small plastic disc with four vertical prongs. The base of the prong is attached to the container with adhesive clay and the block or round floral foam is pressed down onto the prong.

8. SETTING CLAY: Other name of setting clay is ‘dri-hard’ and is used in permanent dry and artificial flower arrangement. This material gets dried out after few hours and it sets properly but the clay and the stems cannot be used again. Plaster of Paris can act as an alternative for securing the stems.

9. NON-SETTING CLAY: This is also available under the name ‘stay-soft’. It is used for dry and artificial flower arrangements, where the plant material is to be removed and reused at a later date or where non-permanent accessories such as candles are to be inserted. Plasticine can be used as an alternative.

10. GLUE: When leaves and flowers needs to be attached in dried flower arrangement the most convenient way to apply the is using glue gun.

11. ADHESIVE TAPE: It is a strong sticky tape which is available in different width narrow and wide both use to make the oasis and chicken wire stable in the container ,it is also known as “Oasis Tape”

12. PEBBLES AND MARBLES: Round marbles or flattened glass nuggets can be used in the vase to hold the stem and to make it more attractive

EQUIPMENT

Tools and other aids which help us in preparing a flower arrangement comes under this category:

1. BUCKET: This equipment is required for collection of flowers and making them submerged in water so that they stay fresh when flower arrangement is done.

2. SPRAY CAN OR MISTER- It is required in giving final look to the arrangement, sprinkling of water makes the appearance of the flowers more fresh and interesting. It is equipment which is very handy also.

3. FLORIST'S SCISSORS: In this, the blades are short and one is serrated. At the base, there may be a notch to be used for cutting thin wires.

4. SHEARS: They are scissors with long blades and short handles, used for cutting flowers, stems, ribbons, stub wire etc. For the very heavy stems and for large woody branches, gardening secateurs are required.

5. SECATEURS: These are used to cut through thick and woody stems (there are narrower ones made especially for the florist).

6. FLORAL TAPE: It is used in binding of artificial stems .

7. WIRE: This is used to support drooping stems and for making posies, corsages, and so on. There are three types of wire, stub wire (strongest; available in green, blue, and black color), rose wire (thinner silver wire), reel wire (available in blue, green, silver, and black; wound on bobbin; extensively used for binding plant material)

8. KNIFE: A craft knife with a sharp blade for scraping stems, removing leaves, and stripping away thorns.

9. WIRE CUTTER: Useful for heavy cutting like chicken wire, plastic stems, and thick stub wire. It has to be handled safely.

10. CANDLE CUPS: Are available in gold, black and white color. They are small containers specially shaped with a "foot" that can be fitted into the neck of a bottle or a candlestick.

11. COCKTAIL STICKS: Use a cocktail sticks or a tooth pick to make holes in florist's foam for a soft stem or to attach a fruit to the foam holding a flower display.

12. TURNTABLE: This is useful for an all-round balanced arrangement.

CONTAINERS

An appropriate container for a fresh-cut floral arrangement

- It holds a sufficient supply of water.
- It has opening which is large enough for flowers and foliage stems.
- It should be suitable to hide or reveal the design mechanics.
- It should be tall enough to support long-stemmed flowers.
- It should always have a stable base to provide physical balance

Common container shapes include:

- Vases (height is greater than width)
- Bowls (width is greater than height)
- Pedestals (elevated by means of foot or pedestal)
- Baskets (textural qualities suggest casual)
- Novelty (various occasions and holidays)

Container size is influenced by the proportion and scale of the arrangement.

The rule of proportion between an arrangement and its container is that the height of the arrangement not exceed 1½ to 2 times the height of a tall container or 1½ times the width of a low container

Containers used for floral arrangements include:

- Plastic (inexpensive; most commonly used)
- Glass (used for vase type arrangements)
- Ceramic (must be glazed to prevent leakage)
- Baskets (require leak-proof lining)
- Metal (requires protective lining)

BASES

These are used and kept underneath the flower arrangement; it gives completeness and an extra appeal to the flower arrangement. It is available in different forms example table mat, tree section, Wood base, Stone base, Covered base, Oriental base

SUPPORT

This refers to the structure on which the container stands. The usual supports are tables, sideboards, alcoves, and shelves.

PLANT MATERIAL

These can be divided into three basic types. Most arrangements use all the three types of plant materials.

Line material: It is the material which gives shape to the flower arrangement; these include tall stems, flowering plants and bold leaves.

Dominant/focal/point material: This consists of bold flowers, dominant or clusters of small showy blooms.

Filler/secondary material: The foliage and small flowers are generally used to cover up the gaps and hide the mechanics in case they are visible.

ACCESSORIES

Accessories are decorative items added to an arrangement to enhance the theme of the arrangement. These items should complement the color harmony and proportion of the arrangement and not detract from them. Some versatile accessories are: basket; bronze lamps; miniature dolls; silk flowers and foliage; tree barks; candles; shells; carved objects; artificial glitter; beads; grain scoops; wooden shapes; ribbons; pottery items; painted wires; and interesting pebbles.

5.4 Conditioning of Plant Material

Flowers should be very delicately handled, if we want to increase the shelf life of the flowers there are certain points which needs to be kept in mind .Flower arrangement use the term 'conditioning' to refer to the preparation of cut plant material for a long life Let us check the important consideration

PREPARATION **(While preparing flower arrangement)**	**AFTERCARE** **(After preparation of flower arrangement)**
➢ Use sharp scissors to cut plant material at a slant either early in the morning or after sunset. ➢ Cut flowers before they get mature.	➢ Do not keep the arrangement or flowers in direct exposure to fan or Air con in order to prevent dehydration. ➢ Do not place near a bowl of fruits as they emit ethylene gas which causes wilting

➢ Heavy headed flowers should be carried down in heads down position. ➢ Ensure enough water for thick and woody stem ➢ Always remove foliage from stem and thorns that fall below the waterline to avoid decay and foul smell. ➢ Wrap the flowers in newspaper till neck ➢ Revive wilting flowers ,snip off half an inch of the stem underwater level and then place it again in water ➢ Coagulate sap of hollow stems of flowers such as Dahlia and marigold, it prevents sap from bleeding out ➢ Shape leaf to resemble its original shape in case trimming away a brown spot	➢ Spray luke warm water from a mister during morning and night hours ➢ Change water every day, do not use chilled water(water at temperature 45 degree is ideal) ➢ To prolong the life of the flower we can add Listerine,ammonia,charcoal,salt, lemonade,sugar,camphor or aspirin. ➢ Use clean containers (use colored glass if possible-darker the glass more slow will be the growth of algae) ➢ After three days, re-cut stem for prolong life of flowers.

5.5 Summary

Flower arrangement owns a major share in making the hotels beautiful. Flowers need to be handled by a person who is skilled and experienced. Various ingredients are required like mechanics, equipments, containers, bases, accessories, plant material and support to make a pleasing arrangement. Principals of flower arrangement makes the arrangement decorative and interesting. Conditioning of flowers should also be kept in mind to make the arrangement stay for long.

5.6 Review Questions

Q1. What is the importance of flower arrangement in Hotels?

Q2. Discuss about various style of flower arrangement?

Q3.What are the principal of making flower arrangement?

Q4. Write a brief note on Mechanics? Explain with examples

Q5.How can we keep the flower arrangement last for long?

Q6.What do mean by Ikebana-Elaborate?

Q7.What are the various Ingredients uses to make flower arrangement?

Q8. List 10 different flowers and foliage use in flower arrangement?

Q9.What are the equipments which we can use while making flower arrangement?

Q10.What is the importance of BALANCE in flower arrangement?

5.7 Key Words

PRONG: It is the simplest type of floral foam anchor. It is a small plastic disc with four vertical attachments. The base of the prong is attached to the container with adhesive clay and the floral foam is pressed down on to the prongs.

ACCESSORIES: These are non-plant materials included in or placed alongside the arrangement. Their purposes are generally decorative but could be functional at times.They are added for extra interest .

CONTAINERS: These are receptacles that hold the flower arrangement. They may or may not be hidden by the plant material.

BASES: An object that is placed underneath the container to protect the surface of the support or to add to the beauty of the display.

FOLIAGE: This is usually refers to leafy plant materials in flower arrangements

FILLERS: These are plant materials used to hide plant stems, the container edges, and most importantly oasis.

HOGARTH: It is also called as S-shaped line arrangement in a tall container .

OASIS: It is a cellular plastic material, available in two types-green foam and brown/grey foam

5.8 References and Further Studies

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill

2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hil

UNIT 6

Flower Arrangement & Types of Indoor Plants

Structure

6.0 Objective

The learner will be able to understand the concept of flower arrangements, the learner will be able to understand the various laws and principles behind the concept o flower arrangement. In the unit the learner will also learn about the care and maintenance of indoor plants.

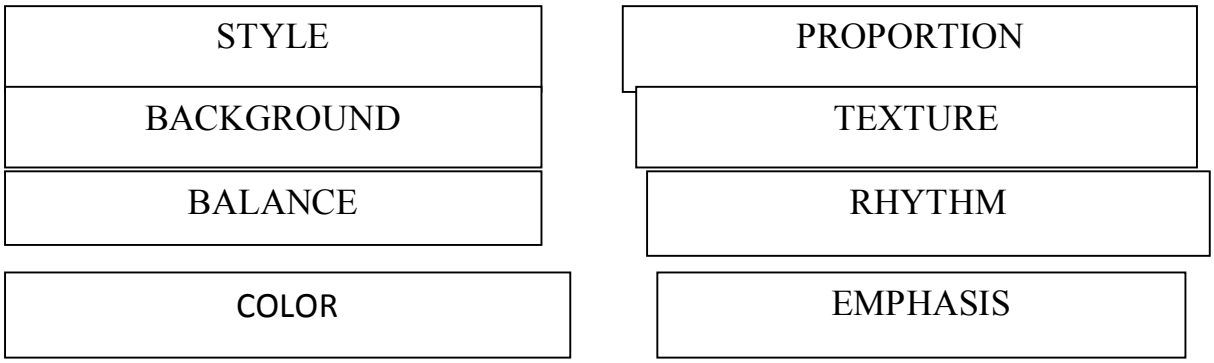
6.1 Introduction

Flower arrangement where ever done holds the eye of the person, it makes the environment so lively and fresh that it has a powerful impact on the person which lasts for a long period of time. There are various type of flower arrangement which is displayed with all different kinds of flowers and foliage and following number of themes. Flower arrangement which is unique in itself is made by a skilled person who follows principals to make the flower arrangement. Principal which forms the guild lines for the florist to make the arrangement according to the requirement, starting from the usage of flowers to the area where is should be displayed requires lots of practice and knowledge.

6.2 Principles of Flower Arrangement

Let us now understand different principal which we should know before preparation of flower arrangement so that the resultant display is best in place.

There are EIGHT principles which will cover all area and allow us to make a beautiful flower arrangement.



6.1.1 STYLE

There are many styles which experts are already using and new styles keep on adding up as it becomes popular and appreciated by people. Before even starting flower arrangement it is essential to known which style of flower arrangement you will prepare, it can be based on different forms of angle from which they are seen, basically a all around arrangement which can be viewed similar from all angles or a facing arrangement which can be viewed front one or two dimensions. The amount of space which is present to display the arrangement will it be a mass style; line style where only peculiar pattern will be formed. The style aspect will also include type of plant material; it could be a foliage arrangement or dried flower arrangement, based on the effect of the arrangement it can be formal, informal, abstract or free style.

There are different types of line arrangement which forms different shape.

Examples: C shape (Crescent shape),S Shape (Hogarth), Triangular shape, circular shape, Right angled shape, Diagonal shape, Flame shape, Fan shape, Horizontal shape, Vertical shape, Parallel shape etc.

(A) FORMAL ARRANGEMENTS

C SHAPE (CRESCENT SHAPE)

This arrangement is dramatic and eye catching; if it is not balanced with frame worthy items it will not give this particular shape.

S SHAPE (HOGARTH CURVE)

Whenever preparing this form of arrangement anchor the foam securely. Bend the stems gently into graceful curves and insert them in place so they balance. Add the focal flowers following the lines of the upper and lower curves. Cluster filler blossoms and foliage the central flowers maintaining the rhythm of the ‘S’.

TRIANGULAR SHAPE

This arrangement has three distinct sides and corners,angles or tips and is a one sided arrangement means it can be viewed from one side,genrally placed at the reception desk,side tables etc.

CIRCULAR ARRANGEMENT

This kind of arrangement is usually put on tables to decorate it.Lobby arrangements in hotels are ususally found in this shape.

FAN ARRANGEMENT

The fan flower arrangement is designed like its namesake. Fan-shaped floral arrangements generally consist of a line of flowers with long, straight stems, such as delphiniums and gladiolus.

HORIZONTAL ARRANGEMENT

A horizontal arrangement is one of the basic arrangement types. It is a low arrangement and is long horizontally. It is often used as a table centerpiece. Making this arrangement is very easy if we known the basics

VERTICAL ARRANGEMENT

It can be displaced in various places for decoration in houses, offices, hotels, parties, event reception etc.

DRIED FLOWER ARRANGEMENT

MISCELLANEOUS ARRANGEMENT

(B) INFORMAL ARRANGEMENT

This type of arrangement has no balance or symmetry. This style can be used in events or weddings depending upon the theme.

(C) ABSTRACT/FREE STYLE

This type of arrangement has no fixed rules or condition to be in correct proportions. They do not have a definite geometric outline; instead the emphasis is on line and space .The individual beauty of each piece of plant material is emphasized instead of

the beauty of an outline shape or a mass., it generally depicts a theme or any type of emotions or any message which needs to be conveyed.

(D) IKEBANA/EASTERN STYLE

Ikebana is the Japanese art of flower arrangement. It is more than simply putting flowers in a container. It is a disciplined art form in which the arrangement is a living thing where nature and humanity are brought together. It is steeped in the philosophy of developing closeness with nature.

As is true of all other arts, ikebana is creative expression within certain rules of construction. Its materials are living branches, leaves, grasses, and blossoms. Its heart is the beauty resulting from color combinations, natural shapes, graceful lines, and the meaning latent in the total form of the arrangement. Ikebana is, therefore, much more than mere floral decoration. In Japan there are various schools who teach this form, few of the popular school are like Sogetsu school, Ohara school.

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6.2.2 PROPORTION

This means that the flower arrangement has to be in scale .The container, plant material, base, and accessories – should result in a beautiful, harmonious appearance. Generally we

categories flower arrangement as big, medium and small size arrangement when ever proportion is discussed about.

iii. BACKGROUND

When flower arrangement is prepared it has to be placed at a place which suits its background also otherwise it will lose its charm. for example if a red color flower arrangement is placed with a red background the arrangement will not stand up ,it will get emerged ,on the other hand in case placed with a white background it will be appreciated.

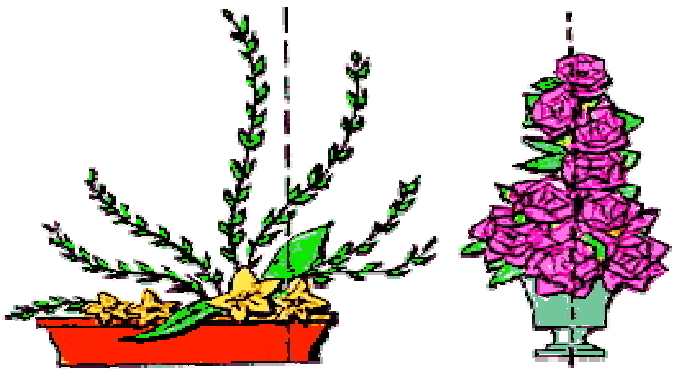
iv. TEXTURE

It refers to the plant material used as well as the container. Variations in texture are necessary to complement and enhance each other.

v. BALANCE

The components of balance are from the size which creates and give the arrangement certain weight and color –usually darker colors flowers give an impression of weight and are generally positioned low in the arrangement, Lighter color and smaller flowers are positioned towards the upper and outer ends of the arrangement

Symmetrical balance or formal balance: This is achieving by placing an equal amount of material on either side of an imaginary vertical line running through the centre of the arrangement. Asymmetrical balance or Informal balance: There is no actual repetition but a visual effect of balance is achieved.



Asymmetrical Balance Symmetrical Balance

vi. RHYTHM

It is movement of eye which travel from one point to other to appreciate the entire arrangement and return to the focal point. It is the central area from which the flowers

and foliage appear to emerge. The emphasis is highlighted by placing a larger brighter or darker accent flower or a cluster of flowers.

vii. COLOR

The color combination is of prime importance in the flower arrangement which makes it more appealing, arrangements with good color combination manages to attract .Different color scheme is used like

Monochromatic: In this various tints and shades of a single hue or color of flower is used.

Analogous: In this more than hues next to each other on a color wheel is used. Tints and shades are important here as they add to the interest and make it more eye appealing.

Contrasting/Complimentary: The color of the flower directly across each other on the color wheel is used, if used properly it appears to be very attractive.

viii. EMPHASIS

Emphasis in floral arrangement is the greater force of a design element, such as more round forms, or more curved lines. Emphasis can be achieved through the use of a dominant color, size, shape or texture, or by using larger forms or stronger colors. Accent may also accomplished by introducing sharp contrast in form, size or color. Flower Arrangements should always have a focal point to attract immediate attention or interest. Accent or emphasis is used to first attract attention to the most important feature in an arrangement (focal point) and from that point to every detail in order of its importance.

Focal point in the centre is the yellow bright sunflower in the centre

NAME OF FEW FLOWERS USED IN FLOWERARRANGEMENT

Roses, Gerberas, orchids, Gladioli, Dahlia, Anthurium, Lily, Carnation, Tuberose, Bird of Paradise, Hollyhocks, Petunias, Bottle Brush, Daisies, Lady lace, Spider lily, Tulips ,Daffodils, Hibiscus

NAME OF FEW FOLIAGE

Palm leaves, Umbrella palms, Bamboos, True ferns, Asparagus ferns, Golden rod, crotons, Ivy, Citrus branches, Copper beech, Boxwood

6.3 Indoor Plant Care

Indoor plants add color, texture and warmth to the home. They allow year-round access to gardening and can even improve air quality. Many houseplants are easy to grow, but they must be given appropriate care in order to thrive. Since plants were probably started in a greenhouse — grown under ideal conditions — moving them into home takes a bit of adjustment on their part.

Proper watering and lighting are the most important components of indoor plant care, but humidity and temperatures also play a role. The trick is to try to replicate the climate of the place that plant came from.

Tropical plants thrive in warm, humid environments, while cacti and succulents prefer hot, dry climes. Of course, your home can't be everything to every plant, but you can take plant needs into consideration when choosing plants. And, with a few tricks, you can convince your green friends that they are living in their ideal environment.

6.3.1 Plant Selection

The first thing to consider when selecting a houseplant is where you want to put it. Then match the space and lighting with the plant's requirements. Do you have a big spot by a sunny window or a small space with moderate light?

Next a plant with beautiful green leaves or a flowering plant. Some flowering houseplants are seasonal while others will bloom year after year

A third consideration is how much time you can devote to a particular plant. A spider plant will take almost any amount of care (or neglect), while an orchid requires significant tender, loving care.

6.3.2 Indoor Plant Care

Water

Potting soil should be kept moist, but not wet. Of course, there are always exceptions — succulents, and other thick-leafed plants do best when the soil dries out between watering. If the soil is kept too dry or too damp the plant's roots will begin to die, which can lead to inadequate growth or even death of the plant.

Dehydration

Do NOT let plants get to the point where they are wilting or the soil is pulling away from the edge of the container. These symptoms indicate dehydration and at this point the plant is already seriously stressed and the roots may be damaged.

Signs of underwatering include:

- Slow leaf growth
- Translucent leaves
- Premature dropping of flowers or leaves
- Brown, yellow or curled leaf edges

Overwatering

Too much water is just as detrimental as too little. Frequent watering forces air from the soil and opens the door for root-killing bacteria and fungus to move in. Overwatering is the number one killer of houseplants.

- Signs of overwatering include:
- Fungus or mold on the soil surface
- Mushy brown (maybe stinky) roots at the bottom of the pot
- Standing water in the bottom of the container
- Young and old leaves falling off at the same time
- Leaves with brown rotten patches

Temperature

Many houseplants thrive in temperatures between 65-75° during the day and 55-60° at night. Of course, temperature preferences vary from plant to plant with tropical plants liking temperatures around 90° (or higher) and other plants growing better in cooler temperatures.

Humidity

Most plants thrive in high humidity — around 80%. Unfortunately, most homes are much drier, especially in the winter when forced heat can even further drop the humidity.

Using a humidifier can help, but there are other ways to increase the moisture in the air near your plants. A small tray containing pebbles and water can boost local humidity as can grouping plants more closely together. Daily misting of the plant's leaves can help as well. For some plants, such as gardenias and orchids, keeping them in a bathroom or the kitchen (both usually have a higher humidity) can help.

Fertilizers

In a potted environment, soil nutrients can eventually deplete. Adding fertilizer can artificially provide these nutrients. However, adding unnecessary fertilizer can be harmful to the plant. Because of this, careful consideration must be taken before fertilizing. If a plant has been in the same potting mix for a year or more and is no longer thriving, then it may be a candidate for nutrient replacement done by using a complete fertilizer at half the recommended label dilution rate.

Fertilizers are usually marked with a number such as 20–20–20. These numbers indicate the percentages of nitrogen, phosphorus, and potassium respectively, the three elements that are needed in the most quantity for plant growth. Nitrogen is essential for green, leafy growth. Phosphorus is essential for flowering or fruiting plants. Potassium is essential for strong roots and increased nutrient uptake. Numbers higher than 15 are usually man-made, chemical fertilizers. Organic fertilizers have a much lower ratio. A 4–2–2 ratio of these elements is usually good for green foliage plants, while a 2–6–4 ratio is usually better for flowering plants. A complete fertilizer will also include the minor and trace elements, such as calcium, magnesium and iron.

6.3.3 Pot types and sizes

Proper pot size is an important factor to consider. A pot that is too large will cause root disease because of the excess moisture retained in the soil, while a pot that is too small will restrict a plant's growth. Generally, a plant can stay in the same pot for two or so years. Pots come in a variety of types as well, but usually can be broken down into two groups: porous and non-porous. Porous pots are usually clay and are highly recommended because they provide better aeration as air passes laterally through the sides of the pot. Non-porous pots such as glazed or plastic pots tend to hold moisture longer and restrict airflow. Another needed feature is drainage holes. Usually pots come with holes in the bottom to allow excess water to flow out of the soil which helps to prevent root rot. If a pot does not have drainage holes, it is best to double pot that plant so the inner pot can be lifted out and the excess water accumulated in the bottom of the outer pot can be removed. Soak old pots thoroughly in a solution of 1 part bleach to 10 parts water to kill any bacteria that may remain.

6.4 Summary

Principles of design are guidelines used to create beautiful compositions. Major principles include proportion, balance, rhythm, and dominance. Proportion is determined by the location of the arrangement, the height of the arrangement, and the materials used in the arrangement. Balance refers to equality in weight, both physical and visual. Physical balance is the stability of plant materials within a container. Visual balance is the perception of equal weight on both sides of the central axis. Visual balance may be symmetrical or asymmetrical. Creating a pathway for the eye to follow is the purpose of rhythm. Two types of rhythm are regular, repeated rhythm and free, variable rhythm. Dominance suggests to the viewer what is important in a design. Dominance can be achieved with plant material, an emphasized design element, a distinct style of design, a theme, or a focal point. A focal point is a center of interest.

6.5 Review Questions

Q1 What are principles of design?

Q2. What is proportion?

Q3. What is balance?

Q4. What is rhythm?

Q 5. What is dominance?

6.6 Suggested Reading

1 Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill

2 Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,

3 Professional Management of Housekeeping Operations, Martin Jones, Wiley

4 Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.

5 Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 7
FIRST AID

Structure

7.0 Objectives

- Student knows about the first kid.
- Student knows about how to dealing with emergency situation.
- Student knows about how to maintain first aid record.

7.1 Introduction

First aid is the assistance given to any person suffering a sudden illness or injury, with care provided to preserve life, prevent the condition from worsening, and/or promote recovery. It includes initial intervention in a serious condition prior to professional medical help being available, such as performing CPR whilst awaiting an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. First aid is generally performed by the layperson, with many people trained in providing basic levels of first aid, and others willing to do so from acquired knowledge. Mental health first aid is an extension of the concept of first aid to cover mental health.

There are many situations which may require first aid, and many countries have legislation, regulation, or guidance which specifies a minimum level of first aid provision in certain circumstances. This can include specific training or equipment to be available in the workplace (such as an automated external defibrillator), the provision of specialist first aid cover at public gatherings, or mandatory first aid training within schools. First aid, however, does not necessarily require any particular equipment or prior knowledge, and can involve improvisation with materials available at the time, often by untrained persons.

First aid can be performed on all animals, although this article relates to the care of human patients.

7.2 First Aid Kit

A **first aid kit** is a collection of supplies and equipment for use in giving first aid,and can be put together for the purpose by an individual or organization or purchased complete. There is a wide variation in the contents of first aid kits based on the knowledge and experience of those putting it together, the differing first aid requirements of the area where it may be used and variations in legislation or regulation in a given area.

The international standard for first aid kits is that they should be identified with the ISO graphical symbol for first aid (from ISO 7010) which is an equal white cross on a green background, although many kits do not comply with this standard, either because they are put together by an individual or they predate the standards.

First aid kits can be assembled in almost any type of container, and this will depend on whether they are commercially produced or assembled by an individual. Standard kits often come in durable plastic boxes, fabric pouches or in wall mounted cabinets. The type of container will vary depending on purpose, and they range in size from wallet sized through to large rucksacks.

It is recommended that all kits are in a clean, waterproof container to keep the contents safe and aseptic. Kits should also be checked regularly and restocked if any items are damaged or are expired out of date.

Airway, Breathing and Circulation

First aid treats the ABCs as the foundation of good treatment. For this reason, most modern commercial first aid kits (although not necessarily those assembled at home) will contain a suitable infection barrier for performing artificial respiration as part of cardiopulmonary resuscitation, examples include:

- Pocket mask
- Face shield

Advanced first aid kits may also contain items such as:

- Oropharyngeal airway
- Nasopharyngeal airway
- Bag valve mask
- Manual aspirator or suction unit
- Sphygmomanometer (blood pressure cuff)
- Stethoscope

The common kits mostly found in the homes may contain: Alcohol, Bandaids, Cotton Balls, Cotton Swabs, Iodine, Bandage, Hydrogen Peroxide.

Trauma injuries

Trauma injuries, such as bleeding, bone fractures or burns, are usually the main focus of most first aid kits, with items such as bandages and dressings being found in the vast majority of all kits.

- Adhesive bandages (band-aids, sticking plasters) - can include ones shaped for particular body parts, such as knuckles
  - Moleskin— for blister treatment and prevention
- Dressings (sterile, applied directly to the wound)
  - Sterile eye pads
  - Sterile gauze pads
  - Sterile non-adherent pads, containing a non-stick teflon layer
  - Petrolatum gauze pads, used as an occlusive (air-tight) dressing for sucking chest wounds, as well as a non-stick dressing
- Bandages (for securing dressings, not necessarily sterile)
  - Gauze roller bandages - absorbent, breathable, and often elastic
  - Elastic bandages - used for sprains, and pressure bandages
  - Adhesive, elastic roller bandages (commonly called 'Vet wrap') - very effective pressure bandages and durable, waterproof bandaging
  - Triangular bandages - used as slings, tourniquets, to tie splints, and many other uses
- Butterfly closure strips - used like stitches to close wounds, usually only included for higher level response as can seal in infection in uncleaned wounds.
- Saline-used for cleaning wounds or washing out foreign bodies from eyes
- soap - used with water to clean superficial wounds once bleeding is stopped
- Antiseptic wipes or sprays for reducing the risk of infection in abrasions or around wounds. Dirty wounds must be cleaned for antiseptics to be effective.
- Burn dressing, which is usually a sterile pad soaked in a cooling gel
- Adhesive tape, hypoallergenic
- Hemostatic agents may be included in first aid kits, especially military or tactical kits, to promote clotting for severe bleeding.

Personal protective equipment

A waterproof Pelican first aid kit.

The use of personal protective equipment or PPE will vary by kit, depending on its use and anticipated risk of infection. The adjuncts to artificial respiration are covered above, but other common infection control PPE includes:

- Gloves which are single use and disposable to prevent cross infection
- Goggles or other eye protection
- Surgical mask or N95 mask to reduce possibility of airborne infection transmission (sometimes placed on patient instead of caregivers. For this purpose the mask should not have an exhale valve)
- Apron

Instruments and equipment

- Trauma shears for cutting clothing and general use
- Scissors are less useful but often included
- Tweezers, for removing splinters amongst others.
- Lighter for sanitizing tweezers or pliers etc.
- Alcohol pads for sanitizing equipment, or unbroken skin. This is sometimes used to debride wounds, however some training authorities advise against this as it may kill cells which bacteria can then feed on
- Irrigation syringe - with catheter tip for cleaning wounds with sterile water, saline solution, or a weak iodine solution. The stream of liquid flushes out particles of dirt and debris.
- Torch (also known as a flashlight)
- Instant-acting chemical cold packs
- Alcohol rub (hand sanitizer) or antiseptic hand wipes

- Thermometer
- Space blanket (lightweight plastic foil blanket, also known as "emergency blanket")
- Penlight
- Cotton swab
- Cotton wool, for applying antiseptic lotions.
- Safety pins, for pinning bandages.

Medication

Medication can be a controversial addition to a first aid kit, especially if it is for use on members of the public. It is, however, common for personal or family first aid kits to contain certain medications. Dependent on scope of practice, the main types of medicine are life saving medications, which may be commonly found in first aid kits used by paid or assigned first aiders for members of the public or employees, painkillers, which are often found in personal kits, but may also be found in public provision and lastly symptomatic relief medicines, which are generally only found in personal kits.

Life saving

- Aspirin primarily used for central medical chest pain as an anti-platelet
- Epinephrine auto injector (brand name Epipen) - often included in kits for wilderness use and in places such as summer camps, to treat anaphylactic shock.

Pain killers

- Paracetamol (also known as Acetaminophen) is one of the most common pain killing medication, as either tablet or syrup
- Anti-inflammatory painkillers such as Ibuprofen, Naproxen or other NSAIDs can be used as part of treating sprains and strains
- Codeine which is both a painkiller and anti-diarrheal

Symptomatic relief

- Anti diarrhoea medication such as Loperamide - especially important in remote or third world locations where dehydration caused by diarrhea is a leading killer of children
- Oral rehydration salts
- Antihistamine, such as diphenhydramine
- Poison treatments
  - Absorption, such as activated charcoal
  - Emetics to induce vomiting, such as syrup of ipecac although first aid manuals now advise against inducing vomiting.

- Smelling Salts (ammonium carbonate)

Topical medications

- Antiseptic ointment, fluid, moist wipe or spray, including benzalkonium chloride, Neomycin, Polymyxin B Sulphate or Bacitracin Zinc.
  - Povidone iodine is an antiseptic in the form of liquid, swabstick, or towelette
- Aloe vera gel - used for a wide variety of skin problems, including burns, sunburns, itching, and dry skin; used as a substitute for triple-antibiotic gel to keep a wound moist and prevent bandages from sticking
- Burn gel - a water-based gel that acts as a cooling agent and often includes a mild anaesthetic such as lidocaine and, sometimes, an antiseptic such as tea tree oil
- Anti-itch ointment
  - Hydrocortisone cream
  - antihistamine cream containing diphenhydramine
  - Calamine lotion, for skin inflammations.
- Anti-fungal cream
- Tincture of benzoin - often in the form of an individually sealed swabstick, protects the skin and aids the adhesion of butterfly strips or adhesive bandages.

Improvised use

Besides its regular use in first aid, many first-aid items can also have improvised uses in a survival situation. For example, alcohol pads and petroleum jelly-based ointments can be used as a fire-starting aid in an emergency, and the latter can even be used as an improvised lubricant for certain mechanical devices, and adhesive tapes and bandages can be used for repairs. These alternate uses can be an important consideration when picking items for a kit that may be used in wilderness or survival situations. An alternative could however also be the use of additional kits with tools such as Survival kits and Mini survival kits.

Workplace first aid kit

In the United States, the Occupational Safety and Health Administration (OSHA) requires all job sites and workplaces to make available first aid equipment for use by injured employees .While providing regulations for some industries such as logging in general the regulation lack specifics on the contents of the first aid kit. This is understandable, as the regulation covers every means of employment, and different jobs have different types of injuries and different first-aid requirements. However, in a non-mandatory section, the OSHA regulations do refer to ANSI/ISEA Specification Z308.1 as the basis for the *suggested* minimum contents of a first aid kit. Another source for modern first aid kit information isUnited States Forest

Service Specification 6170-6 which specifies the contents of several different-sized kits, intended to serve groups of differing size.

In general, the type of first aid facilities required in a workplace are determined by many factors, such as:

- the laws and regulation of the state or territory in which it is located;
- the type of industry concerned; for example, industries such as mining may have specific industry regulations detailing specialised instructions;
- the type of hazards present in the workplace;
- the number of employees in the workplace;
- the number of different locations that the workplace is spread over;
- the proximity to local services (doctors, hospital, ambulance).

Historic first aid kits

Travel pharmacy (early 20th century).

As the understanding of first aid and lifesaving measures has advanced, and the nature of public health risks has changed, the contents of first aid kits have changed to reflect prevailing understandings and conditions. For example, earlier US Federal specifications for first aid kits included incision/suction-type snakebite kits and mercurochrome antiseptic. There are many historic components no longer used today, of course; some notable examples follow. As explained in the article on snakebite, the historic snakebite kit is no longer recommended. Mercurochrome is not approved by the US FDA due to concerns over mercury poisoning. Examples of modern additions include the CPR face shields and specific body-fluid barriers included in modern kits, to assist in CPR and to help prevent the spread of blood borne pathogens such as HIV.

7.3 Dealing With Emergency Situation

Emergency Situations in the Workplace

As a business owner, it is your job to keep your employees safe at work. You can keep your workplace a safe environment by educating your employees on your business procedures for emergency situations. Check out these tips for dealing with emergency situations in the workplace.

Escape Procedures and Routes

It is important to educate your employees on your building's fire escape plans. Explain the best possible way to exit the building, which exits are closest to them and where the alternative exits are located. Decide on a place for your staff to meet once everyone has exited the building. Hold a practice fire drill at least once a year and go over the procedures with new employees between the annual drills. Ask one or two capable employees to perform tasks during an emergency such as announcing an evacuation over the intercom and getting a head count at the meeting place after an evacuation. For more tips on fire prevention and fire safety tips,

If you are unable to escape, you can create an area of refuge by following these steps:

- First, create a barrier between you and the fire. Do this by going into a room that is unaffected by the fire and shut the door. Then, stuff the gap under the door with a wet cloth and close the vents. By doing this you can seal out the smoke and wait safely until help arrives.

- Don't break the windows. If you need air, open the window a crack.
- Stay under the smoke where the air is freshest. Keep a wet cloth over your nose and mouth and try to breathe only through your nose.
- Signal for help by hanging an easy to see object in the window.
- If you have a phone near you, call 100 for help.

Medical Emergency Procedures

If an employee experiences a medical emergency, it is crucial to act quickly. Designate someone at your business to make phone calls to 911, building management (if applicable), and to the victim’s emergency contact person. If it’s necessary and you are able to do so safely, render first

aid to the victim. Always have one person stay with the victim until the paramedics arrive.

Robbery Situations

If your workplace is robbed, the first step is to stay calm and encourage the rest of your employees to do the same. Try to avoid eye contact with the assailant and don't make any sudden movements. Follow his or her demands; whatever he or she wants isn't worth your life or the lives of others. If you have an opportunity to press a silent alarm without being noticed, do so. If your workplace is not equipped with an alarm system, dial 911 inconspicuously and leave the phone line open so the operator can find your address and hear what is going on. Allow the assailant to leave without a fight. When help the police arrive, try to give them as much information about the robber as possible such as height, weight, ethnicity, distinct markings, vehicle license plate, etc.

Suspicious Activity

If you notice a stranger hanging around the lobby, garage or parking lot of your building, do not hesitate to contact the police. Try to give police a description of the person and behavior. Sometimes, these suspicious people are profiling a person or business so they can carry out a crime in the near future. Never let employees walk out of the building by themselves. If possible, install surveillance cameras and lights outside of your building to deter criminal activity. Safety should always be one of you main priorities—especially when it comes to your staff. Talk to your employees about your business' emergency situation procedures today.

7.4 Maintaining Records

Record keeping is an important tool, which will allow employers to monitor the performance of their first aid program. Records provide evidence that you are managing this aspect of workplace safety in relation to your duty of care. This need not be a complicated task and in some cases a simple notebook with the relevant information is all that is required. Most suppliers of first aid equipment also have a range of simple report forms readily available.

Types of records you should keep

Records currently kept

Yes No Comments

Accident records

Treatment records

Health surveillance—medicals, chest x-rays etc

Hazard identification and risk assessments

Periodic inspection of first aid equipment, e.g. oxy viva

Training and qualifications

Hazardous Substance Register—

including material safety data sheets

Records in relation to first aid treatment

- Details of injured person
- Details of accident/injury
- Details of treatment, including name of first aider
- Referral arrangements—return to work, refer to doctor, taken by ambulance
- Subsequent management

Records of assessment of risks must be kept for five years from the last review and this would be a general guide for first aid records. Records of health surveillance must be kept for 30 years. Health records are confidential and must not be released without permission of the person to

whom the record relates.
Other records, such as treatment books, should be kept in a safe place and stored so as to be readily accessible to first aiders only.

7.5Summary

First aid is the assistance given to any person suffering a sudden illness or injury, with care provided to preserve life, prevent the condition from worsening, and/or promote recovery. It includes initial intervention in a serious condition prior to professional medical help being available, such as performing CPR whilst awaiting an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. First aid is generally performed by the layperson, with many people trained in providing basic levels of first aid, and others willing to do so from acquired knowledge. Mental health first aid is an extension of the concept of first aid to cover mental health.

7.6 Review Question

1. What is the medical emergency procedure?
2. Describe the types of first aid kit?
3. Write a short note on first aid?

7.7 Reference

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UNIT 8

AIRCONDITIONING AND REFRIGERATION

Structure

8.0 Learning Objective

Learner will be able to understand

a. the concept of ventilation
b. the working of air conditioners
c. the method of maintaining AC systems

d. Storage temperatures

8.1 Ventilation

Ventilation system is needed in hotels so as to provide proper flow of oxygem and remove stale and impure gases, heat dust etc. It is also needed to remove contaminates such as smoke, lint particals, CO2 etc.

Ventilation means – Free passage of clean air supply of outside air in to or the removal of inside air from an enclosed space.

Types of Ventilation are –

A. General ventilation – Removal of air from or the supply of air to the general area.

B. Diluted Ventilation – Supply of outside air to reduce the airborne contamination in the space.

Reasons for ventilation – The absence of ventilation leads to accumulation of excessive quantity of Carbon di oxide in the in the air, resulting in difficulty in breathing. When the amount of carbon dioxide by volume is 6%, man losses consciousness when it reaches 10%, carbon dioxide should be 0.6%. Ventilation is also required to control dust & other impurities in the air. It is also required to suppress body odors, smoke & concentration of bacteria. It is required to remove condensation. It is required to remove body heat generated by the occupants. It is required to prevent suffocation.

8.2 Air change rate

Air change rate is as follows.

Hotel	2/hr	Restaurant (dinning)	4-20/hr
Restaurant Kitchen	4-60/hr	Barbershop	7.5/hr
Café	7.5/hr	Dinning	4-20/hr
Guest room	3-5/hr	Lobbies	3-4/hr
Lounges	6/hr	Toilet	10-12/hr
Bedroom	1/hr	Public room	1/hr
Laundries	20/hr	Humidity	21%,
Effective temperature	20^0C – Winter 24 ^{0}C- Summer	Relative Humidity	30-70%

Note :-

- Quality of air free from odours, organic matter, inorganic dust unsheathing fumes of gases such as carbon monoxide, carbon dioxide, sulphur – dioxide etc.

- Minimum rate of fresh air restaurant dinning halls $25m^3$/head / hour.

Systems of Ventilation are –

(i) Natural Ventilation.
(ii) Mechanical/Artificial Ventilation Extraction system supply pressure system.
  (a) Inlet.
  (b) Extract.
  (c) Combined supply inlet & Extraction system.
  (d) Plenum Process.
(iii) Localized exhaust Ventilation.

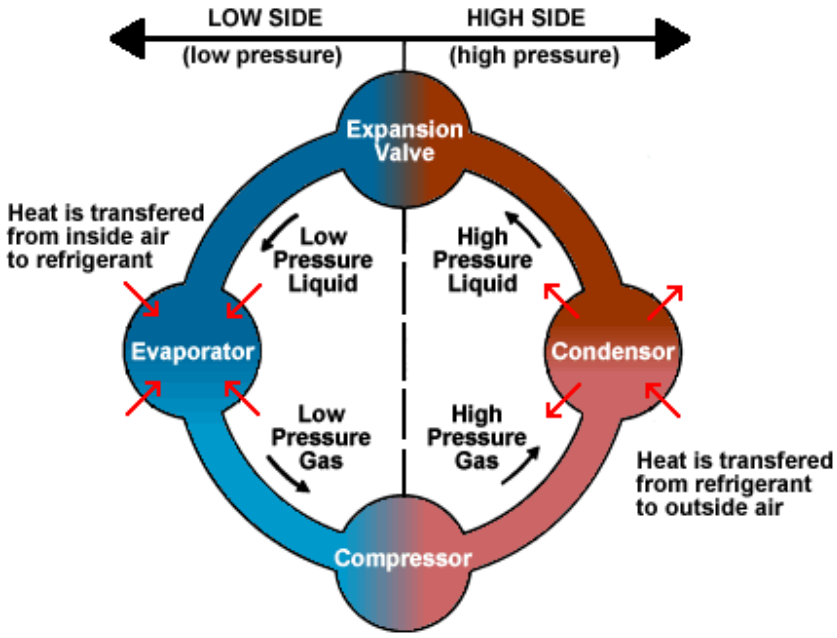
8.3 Principles of Refrigeration

- Liquids absorb heat when changed from liquid to gas
- Gases give off heat when changed from gas to liquid.

For an air conditioning system to operate with economy, the refrigerant must be used repeatedly. For this reason, all air conditioners use the same cycle of compression, condensation, expansion, and evaporation in a closed circuit. The same refrigerant is used to move the heat from one area, to cool this area, and to expel this heat in another area.

- The refrigerant comes into the compressor as a low-pressure gas, it is compressed and then moves out of the compressor as a high-pressure gas.
- The gas then flows to the condenser. Here the gas condenses to a liquid, and gives off its heat to the outside air.
- The liquid then moves to the expansion valve under high pressure. This valve restricts the flow of the fluid, and lowers its pressure as it leaves the expansion valve.
- The low-pressure liquid then moves to the evaporator, where heat from the inside air is absorbed and changes it from a liquid to a gas.
- As a hot low-pressure gas, the refrigerant moves to the compressor where the entire cycle is repeated.

Note that the four-part cycle is divided at the center into a high side and a low side This refers to the pressures of the refrigerant in each side of the system



8.3.1 Compressor

The purpose of the compressor is to circulate the refrigerant in the system under pressure; this concentrates the heat it contains.

- At the compressor, the low pressure gas is changed to high pressure gas.
- This pressure buildup can only be accomplished by having a restriction in the high pressure side of the system. This is a small valve located in the expansion valve.

The compressor has reed valves to control the entrance and exit of refrigerant gas during the pumping operation. These must be firmly seated.

- An improperly seated intake reed valve can result in gas leaking back into the low side during the compression stroke, raising the low side pressure and impairing the cooling effect.
- A badly seated discharge reed valve can allow condensing or head pressure to drop as it leaks past the valve, lowering the efficiency of the compressor.

Two service valves are located near the compressor as an aid in servicing the system.

- One services the high side, it is quickly identified by the smaller discharge hose routed to the condenser.
- One is used for the low side, the low side comes from the evaporator, and is larger than the discharge hose

The compressor is normally belt-driven from the engine crankshaft. Most manufacturers use a magnetic-type clutch which provides a means of stopping the pumping of the compressor when refrigeration is not desired.

Compressor Relief Valve

Some compressors have a relief valve for regulating pressure. If the system discharge pressure exceeds rated pressure, the valve will open automatically and stay open until the pressure drops. The valve will then close automatically.

8.3.2 Compressor Noise Complaints

Many noise complaints are due to the compressor mount and drive.

- If a unit is noisy at one speed and quiet at another, it is not compressor noise.
- Many times this kind of noise can be eliminated or greatly reduced by changing the belt adjustment.
- Usually tightening mounts, adding idlers, or changing belt adjustment and length are more successful in removing or reducing this type of noise, than replacing the compressor.
- Noises from the clutch are difficult to recognize because the clutch is so close to the compressor. A loose bolt holding the clutch to the shaft will make a lot of noise.
- The difference, between suction pressure and discharge pressure, also plays an important part on sound level.
    - A compressor with low suction pressure will be more noisy than one with a higher pressure.
- Consider whether the system is properly charged, whether the expansion valve is feeding properly to use the evaporator efficiently, and whether enough air is being fed over the evaporator coil.

8.3.3 Expansion Valve

The expansion valve removes pressure from the liquid refrigerant to allow expansion or change of state from a liquid to a vapor in the evaporator.

The high-pressure liquid refrigerant entering the expansion valve is quite warm. This may be verified by feeling the liquid line at its connection to the expansion valve. The liquid refrigerant leaving the expansion valve is quite cold. The orifice within the valve does not remove heat, but only reduces pressure. Heat molecules contained in the liquid refrigerant are thus allowed to spread as the refrigerant moves out of the orifice. Under a greatly reduced pressure the liquid refrigerant is at its coldest as it leaves the expansion valve and enters the evaporator.

Pressures at the inlet and outlet of the expansion valve will closely approximate gauge pressures at the inlet and outlet of the compressor in most systems. The similarity of pressures is caused by the closeness of the components to each other. The slight variation in pressure readings of a very few pounds is due to resistance, causing a pressure drop in the lines and coils of the evaporator and condenser.

Two types of valves are used on machine air conditioning systems:

- Internally-equalized valve - most common
- Externally-equalized valve special control

Internally-Equalized Expansion Valve

The refrigerant enters the inlet and screen as a high-pressure liquid. The refrigerant flow is restricted by a metered orifice through which it must pass.

As the refrigerant passes through this orifice, it changes from a high-pressure liquid to a low-pressure liquid (or passes from the high side to the low side of the system).

What happens to the refrigerant as we change its pressure.

As a high-pressure liquid, the boiling point of the refrigerant has been raised in direct proportion to its pressure. This has concentrated its heat content into a small area, raising the temperature of the refrigerant higher than that of the air passing over the condenser. This heat will then transfer from the warmer refrigerant to the cooler air, which condenses the refrigerant to a liquid.

Externally-Equalized Expansion Valve

Operation of the externally-equalized valve is the same as the internal type except that evaporator pressure is fed against the underside of the diaphragm from the tail pipe of the evaporator by an equalizer line. This balances the temperature of the tail pipe through the expansion valve thermal bulb against the evaporator pressure taken from the tail pipe.

8.3.4Evaporator

The evaporator works in the opposite of condenser, here the refrigerant liquid is converted to gas, absorbing heat from the air in the compartment. When the liquid refrigerant reaches the evaporator its pressure has been reduced, dissipating its heat content and making it much cooler than the fan air flowing around it. This causes the refrigerant to absorb heat from the warm air and reach its low boiling point rapidly. The refrigerant then vaporizes, absorbing the maximum amount of heat.

This heat is then carried by the refrigerant from the evaporator as a low-pressure gas through a hose or line to the low side of the compressor, where the whole refrigeration cycle is repeated.

The evaporator removes heat from the area that is to be cooled. The desired temperature of cooling of the area will determine if refrigeration or air conditioning is desired. For example,

food preservation generally requires low refrigeration temperatures, ranging from 40°F (4°C) to below 0°F (-18°C).

A higher temperature is required for human comfort. A larger area is cooled, which requires that large volumes of air be passed through the evaporator coil for heat exchange. A blower becomes a necessary part of the evaporator in the air conditioning system. The blower fans must not only draw heat-laden air into the evaporator, but must also force this air over the evaporator fins and coils where it surrenders its heat to the refrigerant and then forces the cooled air out of the evaporator into the space being cooled.

8.3.5 Fan Speeds

Fan speed is essential to the evaporation process in the system. Heat exchange, as we explained under condenser operation, depends upon a temperature differential of the air and the refrigerant. The greater the differential, the greater the amount of heat exchanged between the air and the refrigerant. A high heat load, as is generally encountered when the system is turned on, will allow rapid heat transfer between the air and the cooler refrigerant.

A blower fan turned on to its highest speed will deliver the most air across the fins and coils for rapid evaporation.

For the coldest air temperature from the evaporator, operate the blower fan at the lowest *speed so the heat will be absorbed by the refrigerant from the air*

Problems of Flooded or Starved Evaporator Coils

Changing the state of the refrigerant in the evaporator coils is as important as the air flow over the coils. Liquid refrigerant supplied to the coils by the expansion valve expands to a vapor as it absorbs heat from the air. Some liquid refrigerant must be supplied throughout the total length of the evaporator coils for full capacity.

A **starved** evaporator coil is a condition in which not enough refrigerant has been supplied through the total coil length. Therefore, expansion of the refrigerant has not occurred through the whole coil length, resulting in poor coil operation and too-low heat exchange.

A **flooded** evaporator is the opposite of the starved coil. Too much refrigerant is passed through the evaporator coils, resulting in unexpanded liquid passing onto the suction line and into the compressor.

Magnetic Clutch

The clutches on machine air conditioning systems are of two types:

- Rotating coil
- Stationary coil

Rotating Coil

- Clutches have the magnetic coil inside the pulley and rotating with it. The electric current is carried to the coil by brushes mounted on the compressor frame and contacting a slip ring mounted on the inside of the rotating pulley.

Stationary Coil

- Clutches have the magnetic coil mounted on the frame of the compressor and it does not rotate. Since the coil is stationary, correct spacing is important to prevent the rotating pulley from contacting the coil, while still bringing the hub and armature into position for the fullest attraction of the magnetic force.
- When replacing either the clutch unit or the coil must note carefully that the voltage of the replacement unit is correct for the vehicle on which it is to be installed.
- All clutches operate on the same principle whether the magnetic coil rotates or is stationary. Each has a wound core located within a metal cup acting like a horseshoe magnet when the coil is energized electrically
- The pulley rotates on a bearing mounted on the clutch hub except the Frigidaire compressor, which mounts the bearing on the compressor front head assembly. The pulley is free to rotate without turning the compressor crankshaft any time the clutch coil is not energized. The free-rotating pulley and non-energized clutch coil stop compressor operation.
- An armature plate is mounted by a hub to the compressor crankshaft and is keyed into place and locked securely with a lock nut, thus making connection to the crankshaft.
- Energizing the clutch coil creates lines of magnetic force from the poles of the electromagnet through the armature, drawing it towards the shoe plate or rotor that is a part of the pulley assembly. The solid mounting of the pulley prevents the pulley from moving in a lateral direction; however, the armature can move until it contacts the rotor. Magnetic force locks the rotor and the armature plate together. This solid connection then allows the pulley to rotate the compressor crankshaft and operate the compressor. Compressor operation will continue until the electrical circuit is broken to the clutch coil, when the magnetic force is de-energized. The rotor and armature then separate, and the pulley rotates freely without rotating the compressor crankshaft.
- Slots are machined into both the armature and the rotor to concentrate the magnetic field and increase the attraction between the two when energized. Some scoring and wear is permissible between these plates. However, it is important that full voltage be available to the clutch coil as low voltage will prevent a full build-up of magnetic flux to the plates.

- The correct spacing between the pulley and the coil on stationary coil models must be maintained to prevent the pulley from dragging against the coil. Correct spacing must also be maintained between the rotor and the armature.
- Too close a clearance will allow the two plates to contact each other in the "OFF" position, while too wide a space can prevent the rotor from contacting the armature solidly in the "ON" position. Any of these variations can cause a serious clutch failure.
- Also be sure that the mating surfaces are not warped (from overheating)

Thermostat and Magnetic Clutch Systems

- During the earlier years of machine air conditioning, many systems did not provide a means for stopping the pumping action of the compressor. A solid pulley was installed on the compressor crankshaft, which resulted in compressor operation anytime the engine, was operating. The only time the compressor could be stopped was when the belt was removed. Even with the air conditioning controls in the "OFF" position during cold weather operation, a slight amount of cold air would be given off by the evaporator
- Today, manufacturers are turning more and more to the thermostat-controlled system with a magnetic clutch.

Thermostat Control

The opening and closing of electrical contacts in the thermostat are controlled by a movement of a temperature-sensitive diaphragm or bellows. The bellows has a capillary tube connected to it which has been filled with refrigerant. The capillary tube is positioned so that it may have either the cold air from the evaporator pass over it or may be connected to the tail pipe of the evaporator.

In either position, evaporator temperature will affect the temperature-sensitive compound in the capillary tube by causing it to contract as the evaporator becomes colder. The contraction of the gas will cause the bellows to contract. This separates the electrical points and breaks the electrical circuit to the compressor clutch, which stops compressor operation.

Now the evaporator begins to warm which, in turn, gas in the capillary tube to expand. The bellows will also expand, moving the electrical circuit to the compressor clutch, energizing it and bringing the compressor into operation again. THis cycle is repeated for as long as the air conditioning is being used.

The thermostatic switch is made from a pivoting frame attached to the bellows. Movement of the bellows during expansion and contraction cause the frame to pivot. Springs control and counteract the movement. Half of the electrical contacts are connected to the frame, the other half are mounted to the switch, but insulated from the metal parts.

The distance the contacts must travel and the spring pressure must be overcome by the expanding gas in the capillary tubes and bellows determine at what degree of evaporator the contacts will close to complete the electrical circuit.

In all thermostats, the spring tension and point spacing may be varied by the operator to regulate evaporator cooling for comfort. Temperature is controlled by rotating a cam (via a knob control) which increases or decreases spring tension of a pivoting point.

8.4 Cold Rooms, Refrigerated Cabinets, Deep-Freeze Cabinets

In large establishments it is necessary to have refrigerated space at different temperatures.

(i) The cold rooms may be divided into separate rooms, one at a chill temperature for storing salads, fruits, certain cheeses; one for meats, poultry, game and tinned food which have to be refrigerated; one for deep frozen foods. Frequently, the cold room storage is designed so that the chill room, the cold room and the deep freeze compartment lead on from each other.

(ii) Refrigerated cabinets, thermostatically controlled to various desired temperatures, are also used in large larders.

(iii) Deep-freeze cabinets are used where a walk in, deep-freeze section is not required and they maintain a temperature of – 18^0C (-0^0 F). deep freeze cabinets require defrosting twice a year.

(iv) Walk in refrigerator- 300- 400 meals/day.

(v) Reach on refrigerator- located adjacent to preparation & production equipment.

Built in under table counters.

(vi) Pan through Refrigeration units.

(vii) Frozen foods – 23.3^0 to -28.9^0C.

(viii) Refrigerated space for thawing purpose.

Throwing space – to handle one adjusted purpose.

Keep foods covered in refrigerated storage to prevent these from drying, prevent odors from one food to another.

(ix) Dry Storage – If the outside temperatures are too high as is sometimes in tropical countries, then the temperature of the store may have to be brought down by air cooling, or the length of storage time of commodities is reduced.

Dry storage is suitable for non- perishable and semi – perishable commodities, the latter being stored for a shorter time.

Food store - This store is mainly for the storage of some semi – perishable and all non – perishable items. The manner in which different foods are stored depends on the quantities in which they are brought and the type and size of the storage space.

While most non – perishables can be stored together in a storeroom, some semi – perishables like under ripe fruits and vegetables, potatoes and onions, bread and eggs require separate ventilated storage facilities. Fruits and vegetables need to be stored for ripening. Firm green tomatoes, under ripe bananas, lemons and other citrus, require a temperature of 18^0C to 24^0C while potatoes and onions require a temperature of 4.4^0C. The latter must, however, be put into storage at 10^0C to 15.5^0C, like breads and bakery products. Where space allows, fats and oils should be stored away from the rest of the food.

TABLE Manner of storing food in dry storage

Food	Unit of Purchase	Method of Storing
Cereals	Jute or polythene bags	Stacked one on top of other in a pile placed on slated platforms for air circulation.
Cereal products	1. Kg packs 1.25 kg packs	In air – tight bins with lids, depending on the quantity.
Pulses and their Products	1.20 kg	1.5 kg can be stored in transparent plastic tic jars with screen bled lids. (Larger quantities as for cereals.)
Nuts and fried products	1.5 kg. Polythene pack	Packs may be placed together in air tight tin and opened only one kg at a time. Once opened the items should be transferred to transparent air – tight jars, neatly labeled and stored.
Eggs	Cardboard trays or cartons	Stored such that, these may be consumed within a day or two or kept in cold store.
Preserved food	Cans, jars,	Store out of carton, or in the cartons on shelves or racks.
Spices and con dements	Generally not more than 1 kg packs(polythene). Glass bottles.	In transparent labeled jars or tins.
Essences and flavorings	Glass bottles	Stored as such
Food colours	Small tins or glass bottles.	Stored as purchased.

8.5 Low Temperature Storage

The principle underlying the designing of low temperature storage is to maintain temperatures at levels which will inhibit the growth of microorganisms, thereby preserving the food. At high temperatures, microbial activity gets accelerated because perishable foods have a relatively high proportion of moisture, providing suitable humidity for spoilage to occur. There are three distinct types of low temperature storages based on different temperature ranges, maintained for the storage of semi – perishable and perishable food :-

(a) Refrigerated storage – Is a storage space planned & maintained at a temperature between 0^0C & 10^0C. it can be in the form of a complete room or a cabinet which is

free standing or fixed in the wall. Such storages are necessary for maintaining the quality of perishable foods for 3-5 days only after which certain changes start taking place in the foods due to enzymatic or microbial activity. A number of sizes of refrigerators are now available to suit the needs of every area in the establishment. Frost – free and automatic defrost models are also marketed for ease of cleaning.

It is good practice to keep foods covered in refrigerated storage to prevent them from drying. This also prevents odors from one food being picked up by another.

The space required for refrigerated storage is determined by the volume of food produced, and the type of menus, along with the accuracy of forecasts of sales. If the menu invoice the use of many of perishable foods or forecasting is incorrect and plenty of food is leftover, then the space required will be greater than if the number of perishable ingredients involve are few, and all that is prepared and is sold. Also, if the menu items involve preparation methods such as soaking, fermenting, and so on, then refrigerated space required is greater so that the degree of fermentation can be controlled over time.

For a canteen or coffee shop in which most foods are sold out each day, one 16 cubic feet refrigerator may be enough to store fresh ingredients like milk, curds, fruits, dough's. In small establishments, the cabinet refrigerators may generally be kept between the kitchen and service areas, for easy access from both sides. In larger establishments, there may be a separate room.

(b) Cold Storage – Cold storage is generally one in which the temperature is maintained between 0^0 and 5^0C, thereby reducing the enzyme activity to a minimum. Such storages are also called 'chill rooms' and can hold perishables for over a week, and in the case of fruits and vegetables, even up a month depending on the stage of ripeness and variety.

(c) Freezer Storage – In freezer storage the temperature ranges from - 20^0C to 0^0C. for successful freezing, it is necessary to blanch foods, cool quickly to freezing temperature and pack in airtight containers or bags in quantities which can be utilized immediately on thawing. A food removed from the freezer storage for the use never be partly or wholly kept back.

Freezer storages may be in the form of wall or wall or free standing cabinets, or part of cabinet in which there is refrigerated storage as well. In the case of large central kitchens, supplying meals to schools, offices, and airlines, freezer storages may be a room designed to maintain the required temperatures. These are also referred to as walk-in freezers. Table shows the recommended temperatures for storage of various perishables.

TABLE Temperatures recommended for storage of perishables

Food	Temperatures
Fruits and vegetables (except bananas)	1.1^0C to 7.2^0C
Dairy products	3.3^0C to 7.8^0C
Meat and poultry	0.6^0C to 3.3^0C
Fish and shellfish	5^0C to 1.1^0C
Frozen foods	18^0 C to 6.7^0C

Maintenance of a Refrigerator –

(1) Keep the fins of the condenser free of lint & dust accumulation. Before cleaning the condenser shut off the system.
(2) Bristle brush may be used for cleaning, vacuuming after brushing.
(3) Directing compressed air at the external surface of the condenser.
(4) To remove grease & oil use a chemical solvent after every three month.
(5) Interior and exterior surfaces cleaned with a solution of warmer water & mild soap or detergent applied with a soft cloth, weekly cleaning M/c disconnect, doors opened & shelves are removed.
(6) Outside surfaces should be cleaned daily.
(7) Galvanized parts can become soiled, develop water marks. Can be removed easily by wiping the area soiled with okay Halite applied with rag & warm water. After the white rust is removed, a light film of oil should be spread over the panel.
(8) Door gaskets should be cleaned on a regular basis with mild soap & warm water.

DEFROSTING – Deposit of ice on evaporator, method of defrosting :-

(a) Manual removal by chipping.
(b) Blasting hot air over evaporator.
(c) Electrical heating of evaporator.
(d) Flushing evaporator with brine, milt ice.
(e) Circulate hot refrigerant gas through enaporator.

8.6 Vapor Absorption Refrigeration Cycle :

(1) Strong solution of ammonia is formed in the absorber, dissolving fairly dry Ammonia Vapour in cold water.

The weak solution containing very little ammonia in sprayed is absorber absorbs ammonia from the evaporator, lower the pressure in absorber & as a result more ammonia Vapour is drawn from the evaporator.

(2) pump.

(3) Heat exchanger.

(4) Heater/generator.

(5) Oil separator.

(6) Ammonia gas expelled from the strong solution in the generator & passes on the condenser.

(7) Throttle Valve lowers the pressure.

(8) Evaporator absorbs heat.

Advantages of vapour absorption cycle –

(i) Moving part is pump
(ii) Reduced vaporization pressure & temperature
(iii) Load variation does not affect performance
(iv) Capacity > 1000 T, 30TR 97% electricity saves.

Disadvantages of vapour absorption cycle –

(a) Efficiency is low
(b) Takes long time to produce cooling effect
(c) Kerosene/oil /gas flame gives bad smell.

8.6.1 Comparison Of Absorption & Compression Refrigeration Machines:

	Vapur absorption cycle	**Vapour compression cycle**
Power consumption	3 Kwh	100 Kwh
Steam consumption	450 Kwh	-
Oil consumed	30 Kwh	-
Operation cost	Rs. 220/ hr	Rs. 330/hr
Maintenance cost	Rs. 30000/Yr.	Rs. 1,30,000/Yr.
Running cost	Rs. 17,90,000	Rs. 27,70,000/Year

8.7 Double Stage Vapour Absorption Refrigeration Machine

The water lithium bromide absorption system is used in these machines.

This is a based on three basic facts –

(a) Boiling temperature of water is a function of pressure. At lower pressure it boils at lower temperature.
(b) Lithium bromide salt has the property to absorb water due to its chemical affinity. It is soluble in water. As the concentration of lithium bromide increases its affinity towards water increases and as its temperature increases its affinity decreases.
(c) Water flash cools to about 4^0C at an absolute pressure of 6 mm Hg. Produces the refrigeration effect by picking up the latent heat from the external chilled water line. The vaporized refrigerant needed to be liquefied by absorbed heat of dilution, is removed by using cooling water.

The lithium bromide is heated by an external heat source. Refrigerated vapour (water) leaves Lithium Bromide concentrated solution. The refrigerated vapour is condensed using external cooling water in the condenser. This operation is for single stage absorption cycle. In the double stage the generation of refrigerant vapour is generated in the first stage acting as the heating source for the second stage.

These machines are used from 70 to 1400 TR.

Advantages –

(a) Easy maintenance – less moving parts, noise free, less vibration.
(b) Less electricity is needed.
(c) Low operating cost.
(d) Restriction the manufacture of chlorofluro carbon which is used in vapour compression cycle.
(e) Low system cost.
(f) Cold and hot water both can be obtained.
(g) No standby Is required.

8.7.1 Solar Absorption Refrigeration System :

Water heated in a flat plate collector array is passed through a generator where it transfers heat to a solution mixture of absorbents and refrigerant vapour is boiled off and goes to the condenser. The liquid is then throttled in the expansion valve and passes through the evaporator (cooled space) then it goes to absorber coil & generator.

8.7.2 Fully Automatic Ice Plant

By changing the freezing time it is possible to produce either block ice of 25 Kg or crushed ice.

These ribbed and rectangular ice blocks are easier to handle and to stack than the tapered flat blocks from the conventional type of ice plant.

Crushed ice is suitable for the cooling of bottled milk fruits, vegetables, fishes, meat, chemicals, concrete etc.

8.7.3 Modular Cold Storages

Packaged refrigeration units for cold storages :

- Compact and lightweight
- Easy to install and maintain.
- Primary air- cooled.
- Occupies less valuable floor space.
- Completely pre- engineered, pre-charged and tested.
- Electronic temperature indicators.
- One touch push buttons type operations.
- Hot gas/electric defrost systems.
- Do not require any manpower assistance.

Technical characteristics of cold room –

- Use of sandwich polyurethane panels.
- Inside and outside sheets are galvanized steel. Plastified steel/preprinted aluminum, non-toxic type to assure hygiene and cleanliness.
- Fastenings are cam locks for easy assembly and disassembly for small cold rooms.
- Door is part of the walls with edge reinforced, with shockproof plastic profile hinges, handles with lock, with key and inside bottom opening.
- Polyurethane foams are in accordance with environmental rules.

8.7.4 Refrigeration In Catering

(a) Preservation of food/icecream/deep frozen foods.

(b) Cooling of food to a temperature suitable for serving

(c) Cooling of drink

(d) Ice water

(e) Cooling of food & drink for sale – Vending m/c

(f) Ice Making

(g) Air conditioning

(h) Bakery

(i) Fish storage

8.7.5 Precaution In Refrigerating System

(i) Refrigerator - well far away from boilers & cooking appliance. Air cooled condenser.

Goods – kept inside the refrigerator at room temperature products should be kept in refrigerator after removing from hot source to attain room temperature.

Temperature – 23.3^0C. to 17.8^0C.

8.7.6 Refrigerant

Requirements –

(a) Non poisonous
(b) Non explosive
(c) Non corrosive
(d) Non flammable
(e) Leakage should be detected easily & located
(f) Low boiling point
(g) Stable gas
(h) Non toxic
(i) Well balanced enthalpy of evaporation
(j) Vaporizing pressure & condensing pressure difference should be minimum.
(k) Condensing pressure- low.
(l) Critical temperature should be high.
(m) Latent heat of vaporization high.
(n) Specific heat of liquid should be low.
(o) Specific volume of vapour should be low.
(p) Inert to oil.
(q) Easy availability.

8.8 Refrigeration Plant Selection

Refrigeration plant selection is a much debated major issue.

(i) Vapor compression systems alone offer, reciprocating, centrifugal and screw compressors.

(ii) Vapor absorption systems, steam fired and direct fired are becoming competitive with escalating electricity tariffs.

(iii) Natural as which can be used in a direct fired absorption machine or even in a gas engine.

Comparative figures of cost per tone of refrigeration for various alternate refrigeration systems are -

- A reciprocating system breaks even with vapour absorption system at Rs. 4.1 per KWh.
- A centrifugal system breaks even at Rs. 5.0 per KWh.

- Vapour absorption systems are gaining over vapour compression as the electricity tariffs escalate, but at the same time escalating fuel oil prices are negating the advantage.
- Natural gas, wherever, available presents a variable alternative as the cost of refrigeration will be as low as Rs. 2/ per tone hour with gas fired vapour absorption system which is better than electric driven centrifugal and screw chillers.
  Another alternative for a hotel is to have diesel engine generated power supply as a prime source of power and regard the grid supply as a stand by. In such case the hotel has to pay for the sanctioned maximum demand which will add about Rs. 0.6 per KWh resulting in an overhaul unit charge of Rs. 3.3 to 3.5 per KWh.

8.9 Air Conditioning

Air conditioning is used to give proper temperature, humidity & clean air –

(i) Temperature 18.83^0C Winter season

20.55^0C Summer season.

(ii) Humidity 50-60%

(iii) Air movement

(iv) Air Cleanliness

(v) Ventilation

(vi) Noise level.

Human body temperature 37^0C

Advantages of air conditioning –

(a) Better quality of work
(b) Controlled humidity
(c) Reduces corrosion
(d) Better psychological atmosphere
(e) Comfort
(f) Active & efficient.

8.10 Psychrometry

(i) Dry bulb temperature – It is the temperature recorded by a the thermometer which is not affected by moisture.

(ii) Dew point temperature – It is the temperature of air at which water vapour in air starts condensing.

(iii) Humidity ratio or specific humidity – It is the mass in kg. of water vapour contained in the air vapour mixture per kg. of dry air.

It is the ratio of the mass of water vapour to the mass of dry air in certain volume of mixture.

(iv) Wet bulb temperature – Bulb is covered with muslin wick wetted with water is moved past unsaturated air at velocity of 300m/minute. The temperature reading obtained is wet bulb temperature.

(v) Absolute humidity - Actual quantity of water in a given amount of air.

(vi) Load on air conditioning system – Amount of heat that must be removed from air of a given space.

(vii) Duct – Used for distributing air in the building at different places.

8.11 Air Conditioning Classification

(A) According to the purpose of air conditioning, it can be classified –

(a) Comfort air conditioning – To maintain a comfortable surrounding conditions for human beings. Supply of oxygen and removal of carbon dioxide. Remove body heat and moisture, air movement and air distribution, purity of air.

(b) Industrial air conditioning – To control the condition of atmosphere connected with manufacturing process.

(c) Hospital, hotel air conditioning –

(B) According to equipments arrangement- air conditioning can be classified –

(a) Unitary system – System is factory assembled, eg. Window Air conditioner, room air conditioner, etc.

Advantages of unitary systems –

(i) Moderate cost

(ii) Flexibility in operation

(iii) Saving in installation cost

(iv) Duct work is eliminated.

(v) Exact requirement of each room is met. According to the volumetric space air conditioner capacity is selected. Normally for 1000 cu ft. space 1 Tonne air conditioner is suitable.

(vi) When cooling is needed then unit is operated

(vii) Failures of one unit affect one space only.

(b) Central air conditioning unit – More than 25T, 2000 M^3air/minute. All equipments are kept at central place cold air is circulated to different places by means of duct.

Maintaining central air conditioning system –

(i) Check for the possibility of leaking of refrigerant.

(ii) Check for loose or Worn drive belts.

(iii) Improve internal operating pressure in the system.

(iv) A filter should be checked once a month to see if it needs cleaning or replacing. Remove filter & hold to a bright light, then try to look through it if you can see the light easily.

(v) Outside mounted condensing unit It should be cleaned of accumulated especially near inlet & outlet discharge grills, use a brush or hose clean out leaves & wind blown dirt or dust.

(vi) Use a vacuum cleaner once a month to clean off the louvers and once a year remove them entirely so that you can clean of the back of the louver as well as the inside of the ducts as far as you can reach easily.

Central air conditioning advantages –

(a) Low in initial cost.
(b) Equipment can be located away from the space to be air conditioned.
(c) Low maintenance cost
(d) Exhaust air can be reused
(e) Less vibration.

(C) According to season in which air conditioning is used –

(a) Summer – Net sensible heat gain. Reduction of water vapour. Net latent heat gain, dehumidification.

(b) Winter –Sensible heat gain, direct solar heat through glasses. Internal occupancy & appliances. Sensible & latent heat loss. Sensible heat loss through walls & glasses. Heat the air by heating coil.

(c) Year round – Individual difference. Human comfort, moisture. Supply of oxygen distribution. Removal of Co_2 sited at rest in still air generally 101 K cal/hr 21.1^{0}C50% R H, 85 m2/ person/hr. 3-5 times per 1 hour. Air movement.

8.12 Review Questions

1. Define ventilation. Why ventilation is necessary ?
2. Write the factors affecting ventilation.
3. Define refrigeration.
4. What are refrigeration systems ?
5. Explain vapour compression refrigeration cycle. What are advantages and disadvantages of vapour compression cycle ?
6. Explain vapour absorption refrigeration cycle.
7. Write about solar absorption refrigeration system.
8. Write about ice plant.
9. What are the uses of refrigeration in catering ?
10. Discuss the basic scientific principles behind refrigeration.
11. Write about maintenance of refrigerator.
12. Define air conditioning with the help of neat diagram.

8.13 Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 9

FUELS

9.0 Objective

- Students know about types of fuel which is used in catering industry;
- They know about calorific value;
- They can do comparative study of different fuels,
- They can do Calculation of amount of fuel required and cost

9.1 Introduction

Fuels are any materials that store potential energy in forms that can be practicably released and used for work or as heat energy. The concept originally applied solely to those materials storing energy in the form of chemical energy that could be released through combustion, but the concept has since been also applied to other sources of heat energy such as nuclear energy (via nuclear fission or nuclear fusion).The heat energy released by many fuels is harnessed into mechanical energy via an engine. Other times the heat itself is valued for warmth, cooking, or industrial processes, as well as the illumination that comes with combustion. Fuels are also used in the cells of organisms in a process known as cellular respiration, where organic molecules are oxidized to release un-usable energy. Hydrocarbons are by far the most common source of fuel used by humans, but other substances, including radioactive metals, are also utilized. Fuels are contrasted with other methods of storing potential energy, such as those that directly release electrical energy (such as batteries and capacitors) or mechanical energy (such as flywheels, springs, compressed air, or water in a reservoir).Chemical fuels are substances that release energy by reacting with substances around them, most notably by the process of oxidation.

9.2 Types of fuel used in catering industry

Chemical fuels are divided in two ways. First, by their physical properties, as a solid, liquid or gas. Secondly, on the basis of their occurrence: primary (natural fuel) and secondary (artificial fuel). Thus, a general classification of chemical fuels is:

General types of chemical fuels

	Primary (natural)	Secondary (artificial)
Solid fuels	wood, coal, peat, dung, etc.	coke, charcoal
Liquid fuels	petroleum	diesel, gasoline, kerosene, LPG, coal tar, naptha, ethanol
Gaseous fuels	natural gas	hydrogen, propane, coal gas, water gas, blast furnace gas, coke oven gas, CNG

FUEL: Any source of heat energy is called fuel.

The material which is burnt to produce heat is known as fuel. For example, wood, coal, domestic gas (LPG), kerosene diesel, and petrol are used as fuels in home, industries and for transport. When a fuel is burnt, it combines with oxygen in the air to form carbon dioxide and water vapor. A lot of energy (heat and sometimes light) is also produced during this process.

Primary Fuel: - Found in abundance in nature and used in natural form, e.g. coal, wood etc.

Secondary Fuel. - Requires some refining or processing or mixing e.g. petrol, kerosene, disel.etc. Other forms of classification are:

1. **Solid**: coal, wood, peat, lignite, Anthracite, Bituminous

2. **Liquid**: petrol, diesel, kerosene, spirit, coal tar

3. **Gaseous**: LPG, CNG, Methane, compressed butane

4. **Electricity** and

5. Conventional fuel, e.g., solar energy, biomass.

Properties of ideal fuel:

- Low ignition point and high calorific value
- Produces minimum amount of smoke

- Should be easy to store & convenient for transportation and economical
- Has moderate rate of combustion
- Has low content of non volatile material
- Is readily and available in plenty
- Produces no poisonous products on combustion

Solid fuel

Coal is an important solid fuel. Solid fuel refers to various types of solid material that are used as fuel to produce energy and provide heating, usually released through combustion. Solid fuels include wood (see wood fuel), charcoal, peat, coal, Hexamine fuel tablets, and pellets made from wood (see wood pellets), corn, wheat, rye and other grains. Solid-fuel rocket technology also uses solid fuel (see solid propellants). Solid fuels have been used by humanity for many years to create fire. Coal was the fuel source which enabled the industrial revolution, from firing furnaces, to running steam engines. Wood was also extensively used to run steam locomotives. Both peat and coal are still used in electricity generation today. The use of some solid fuels (e.g. coal) is restricted or prohibited in some urban areas, due to unsafe levels of toxic emissions. The use of other solid fuels such as wood is decreasing as heating technology and the availability of good quality fuel improves. In some areas, smokeless coal is often the only solid fuel used. In Ireland, peat briquettes are used as smokeless fuel. They are also used to start a coal fire.

Liquid fuel

Liquid fuels are combustible or energy-generating molecules that can be harnessed to create mechanical energy, usually producing kinetic energy; they also must take the shape of their container. It is the fumes of liquid fuels that are flammable instead of the fluid. Most liquid fuels in widespread use are derived from fossil fuels; however, there are several types, such as hydrogen fuel (for automotive uses), ethanol, and biodiesel, which are also categorized as a liquid fuel. Many liquid fuels play a primary role in transportation and the economy.

Some common properties of liquid fuels are that they are easy to transport, and can be handled with relative ease. Also they are relatively easy to use for all engineering applications, and home use. (Fuels like Kerosene are rationed and available in government subsidized shops in India for home use.) Liquid fuels are also used most popularly in Internal combustion engines. Most liquid fuels used currently are produced from petroleum. The most notable of these is gasoline. Scientists generally accept that petroleum formed from the fossilized remains of dead plants and animals by exposure to heat and pressure in the Earth's crust. Conventional diesel is similar to gasoline in that it is a mixture of aliphatic hydrocarbons extracted from petroleum. Kerosene is

used in kerosene lamps and as a fuel for cooking, heating, and small engines. Natural gas, composed chiefly of methane, can be compressed to a liquid and used as a substitute for other traditional liquid fuels. LP gas is a mixture of propane and butane, both of which are easily-compressible gases under standard atmospheric conditions. It offers many of the advantages of compressed natural gas (CNG), but is denser than air, does not burn as cleanly, and is much more easily compressed. Commonly used for cooking and space heating, LP gas and compressed propane are seeing increased use in motorized vehicles; propane is the third most commonly used motor fuel globally.

Gaseous fuels

Fuel gas is any one of a number of fuels that under ordinary conditions are gaseous. Many fuel gases are composed of hydrocarbons (such asmethane or propane), hydrogen, carbon monoxide, or mixtures thereof. Such gases are sources of potential heat energy or light energy that can be readily transmitted and distributed through pipes from the point of origin directly to the place of consumption. Fuel gas is contrasted with liquid fuels and from solid fuels, though some fuel gases are liquefied for storage or transport. While their gaseous nature can be advantageous, avoiding the difficulty of transporting solid fuel and the dangers of spillage inherent in liquid fuels, it can also be dangerous. It is possible for a fuel gas to be undetected and collect in certain areas, leading to the risk of a gas explosion. For this reason, odorizers are added to most fuel gases so that they may be detected by a distinct smell. The most common type of fuel gas in current use is natural gas.

Bio fuels

Bio fuel can be broadly defined as solid, liquid, or gas fuel consisting of, or derived from biomass. Biomass can also be used directly for heating or power—known as biomass fuel. Bio fuel can be produced from any carbon source that can be replenished rapidly e.g. plants. Many different plants and plant-derived materials are used for bio fuel manufacture.

Perhaps the earliest fuel employed by humans is wood. Evidence shows controlled fire was used up to 1.5 million years ago at Swartkrans, South Africa. It is unknown which hominid species first used fire, as both Australopithecus and an early species of Homo were present at the sites. As a fuel, wood has remained in use up until the present day, although it has been superseded for many purposes by other sources. Wood has an energy density of 10–20 MJ/kg. Recently bio fuels have been developed for use in automotive transport (for example Bio ethanol and Biodiesel), but there is widespread public debate about how carbon efficient these fuels are.

Fossil fuels

Fossil fuels are hydrocarbons, primarily coal and petroleum (liquid petroleum or natural gas), formed from the fossilized remains of ancient plants and animals by exposure to high heat and

pressure in the absence of oxygen in the Earth's crust over hundreds of millions of years. Commonly, the term fossil fuel also includes hydrocarbon-containing natural resources that are not derived entirely from biological sources, such as tar sands. These latter sources are properly known as mineral fuels.

Fossil fuels contain high percentages of carbon and include coal, petroleum, and natural gas. They range from volatile materials with low carbon: hydrogen ratios like methane, to liquid petroleum to non-volatile materials composed of almost pure carbon, like anthracite coal. Methane can be found in hydrocarbon fields, alone, associated with oil, or in the form of methane catharses. Fossil fuels formed from the fossilized remains of dead plants by exposure to heat and pressure in the Earth's crust over millions of years. This biogenic theory was first introduced by German scholar Georg Agricola in 1556 and later by Mikhail Lomonosov in the 18th century. It was estimated by the Energy Information Administration that in 2007 primary sources of energy consisted of petroleum 36.0%, coal 27.4%, natural gas 23.0%, amounting to an 86.4% share for fossil fuels in primary energy consumption in the world. on-fossil sources in 2006 included hydroelectric 6.3%, nuclear 8.5%, and others (geothermal, solar, tidal, wind, wood, waste) amounting to 0.9%. World energy consumption was growing about 2.3% per year.

Fossil fuels are non-renewable resources because they take millions of years to form, and reserves are being depleted much faster than new ones are being made, So we must conserve these fuels and use it judiciously. The production and use of fossil fuels raise environmental concerns. A global movement toward the generation of renewable energy is therefore under way to help meet increased energy needs. The burning of fossil fuels produces around 21.3 billion tonnes (21.3 gig tonnes) of carbon dioxide (CO_2) per year, but it is estimated that natural processes can only absorb about half of that amount, so there is a net increase of 10.65 billion tonnes of atmospheric carbon dioxide per year (one tonne of atmospheric carbon is equivalent to 44/12 or 3.7 tonnes of carbon dioxide).Carbon dioxide is one of the greenhouse gases that enhances radioactive forcing and contributes to global warming, causing the average surface temperature of the Earth to rise in response, which the vast majority of climate scientists agree will cause major adverse effects. Fuels are a source of energy.

Nuclear

Nuclear fuel is any material that is consumed to derive nuclear energy. Technically speaking this definition includes all matter because any element under the right conditions will release nuclear energy, the only materials that are commonly referred to as nuclear fuels though are those that will produce energy without being placed under extreme duress. Nuclear fuel is a material that can be 'burned' by nuclear fission or fusion to derive nuclear energy. Nuclear fuel can refer to the fuel itself, or to physical objects (for example bundles composed of fuel rods) composed of the fuel material, mixed with structural, neutron moderating, or neutron reflecting materials.

Most nuclear fuels contain heavy fissile elements that are capable of nuclear fission. When these fuels are struck by neutrons, they are in turn capable of emitting neutrons when they break apart. This makes possible a self-sustaining chain reaction that releases energy with a controlled rate in a nuclear reactor or with a very rapid uncontrolled rate in a nuclear weapon.

The most common fissile nuclear fuels are uranium-235 (235U) and plutonium-239 (239Pu). The actions of mining, refining, purifying, using, and ultimately disposing of nuclear fuel together make up the nuclear fuel cycle. Not all types of nuclear fuels create power from nuclear fission. Plutonium-238 and some other elements are used to produce small amounts of nuclear power by radioactive decay in radioisotope thermoelectric generators and other types of atomic batteries. Also, light nuclides such as tritium (3H) can be used as fuel for nuclear fusion. Nuclear fuel has the highest energy density of all practical fuel sources.

Fission

Nuclear fuel pellets are used to create nuclear energy. The most common type of nuclear fuel used by humans is heavy fissile elements that can be made to undergo nuclear fission chain reactions in a nuclear fission reactor; nuclear fuel can refer to the material or to physical objects (for example fuel bundles composed of fuel rods) composed of the fuel material, perhaps mixed with structural, neutron moderating, or neutron reflecting materials. The most common fissile nuclear fuels are 235U and 239Pu, and the actions of mining, refining, purifying, using, and ultimately disposing of these elements together make up the nuclear fuel cycle, which is important for its relevance to nuclear power generation and nuclear weapons.

Fusion

Fuels that produce energy by the process of nuclear fusion are currently not utilized by man but are the main source of fuel for stars. Fusion fuels tend to be light elements such as hydrogen which will combine easily. Energy is required to start fusion by raising temperature so high all materials would turn into plasma, and allow nuclei to collide and stick together with each other before repelling due to electric charge. This process is called fusion and it can give out energy.

In stars that undergo nuclear fusion, fuel consists of atomic nuclei that can release energy by the absorption of a proton or neutron. In most stars the fuel is provided by hydrogen, which can combine together to form helium through the proton-proton chain reaction or by the CNO cycle. When the hydrogen fuel is exhausted, nuclear fusion can continue with progressively heavier elements, although the net energy released is lower because of the smaller difference in nuclear binding energy. Once iron-56 or nickel-56 nuclei are produced, no further energy can be obtained by nuclear fusion as these have the highest nuclear binding energies. The elements then on use up energy instead of giving out when fused, and therefore fusion stops and the stars die. In attempts by humans, fusion is only carried out with hydrogen (isotope of 2 and 3) to form

helium-4 as this reaction gives out the most net energy. Electric confinement (ITER), inertial confinement(heating by laser) and heating by strong electric currents are the popular methods used. .Fuel is any substance capable of chemical combustion with oxygen producing heat and light. Calorific Value: number of heat units produced by complete combustion of unit quantity of fuel.

9.3 Calorific Value

Engineer A. Marjhevskee determined the calorific values of different kinds of wood with the help of the samples taken out from the same tree at different distances from centre. The calorific values are given in Table below

Calorific Values of Wood

Kinds of Wood	Lowest Calorific Value(cal/kg)	Highest Calorific Value(cal/kg)
Oak	4729	4750
Birch	4695	4831
Elm	4674	4833
Alder	4745	4839
Pine	4818	5310
Fir	4887	4900
Lrch	4775	4840

Ash

The ash content of wood is negligible. The ash consists of mineral water that is found in the wood itself, with an admixture of some impurities which accure during transportation, etc. The mineral matte is distributed in the tree rather irregularly. The ash consists of mainly potassium carbonate with varying degrees of calcium, magnesium and sodium carbonate, as well as minute quantities of iron oxides, alumina and silica. Pure ash is white in colour.

Moisture

A freshly felled tree anything from 40% to 60% of hygroscopic moisture depending upon the species of the tree as well as the seasons of the year. On exposure to atmospheric air, the moisture dries up and reduces to 15-20% in about 18 months. On the exposure for a longer period, no appreciable change had been observed. When wood is seasoned in water, it absorbs nearly 150% of water by weight.

Characteristics of Flame

The nature of the flame depends on the tar content of wood. Pine and birch contain more tar and hence burn with a thick and bright flame, while aspen and alder burn with a dim, transparent flame. The length of the flame also depends on the tar content.

Combustion Characteristics

The lighter the wood, the more intensely it burns with a long flame. This is because air penetrates easily throughout the whole piece during combustion. If the wood is heavy, i.e. hard, the penetration of air is rendered difficult and a concentrated flame results with the development of more heat at the point of burning.

Ignition Temperature

Wood ignites very easily. That is why it is used for lighting other fuels. The average ignition temperature of different kinds of wood is given in Table 3.7.

Type of Wood	Ignition Temperature (o C)
Pine	295
Oak	287
Larch	290
Fir	292

Calorific values of solid, liquid and gaseous fuels

Solid and liquid fuels	*Gross calorific value*/ MJ kg^{-1}
Alcohols Ethanol	30
Methanol	23
Coal and coal products Anthracite (4% water)	36
Coal tar fuels	36–41
General purpose coal (5–10% water)	32–42
High-volatile coking coals (4% water)	35
Low temperature coke (15% water)	26
Medium-volatile coking coal (1% water)	37
Steam coal (1% water)	36

Peat Peat (20% water)	16
Petroleum and Petroleum Products	
Diesel fuel	46
Gas oil	46
Heavy fuel oil	43
Kerosine	47
Light distillate	48
Light fuel oil	44
Medium fuel oil	43
Petrol	44.8–46.9
Wood Wood (15% water)	16

Gaseous fuels at* 15 °C, 101.325 kPa, *dry	***Gross calorific value*/MJ m^{-3}**
Coal gas coke oven (debenzolized)	20
Coal gas continuous vertical retort (steaming)	18
Coal gas low temperature	34
Commercial butane	118
Commercial propane	94
North Sea gas natural	39
Producer gas coal	6
Producer gas coke	5
Water gas carburetted	19
Water gas blue	11

9.4 Comparative Study of Different Fuels:

SOLID FUELS:

WOOD: Good domestic fuel. In industry may be used for Boiler furnace. Contain large amount of moisture, has low thermal value. Calorific value around 4,700 Kcal/kg.

Coal: most extensively used solid fuel, used for both industrial and domestic purposes. Average Calorific value is 7,750Kcal/kg.

Coke: Mainly used for domestic purpose. Has higher calorific value.

LIQUID FUELS: are petrol, kerosene, diesel oil etc.

Points in their favour are:

1. Combustion control easily.
2. Require less storage space.
3. Relative cleanliness.

Used to great extent for I.C. Engineers but to lesser extent for steam raising purpose.

GASEOUS FUELS: may be natural or manufactured.

Advantages: can be easily transported combustion control effective smoke and ash eliminated

Calorific value:

Coal gas – 5,000 Kcal/m3

Cake Oven – 4,000 Kcal/m3

Producer Gas – 1,400 Kcal/m3

L.P.G. – 722 Kcal/m3

L.P.G.: liquid petroleum Gas contains methane, propane, butane etc. gases as constituents. On applying pressure to this mixture of natural gas, a liquid mixture of gas obtained and this liquid is known as L.P.G. Calorific value of this is higher than that of natural gas obtained from oil walls. Therefore, it is a better gaseous fuel.

Comparison of different fuels

Fuels type	SOLID FUEL	lIQUID FUEL	GASEOUS FUEL	ELECTRICITY
Advantages	1.Low maintenance cost 2.Easily available 3.Thickest type of fuel 4.No expert required to take care 5.Easy to transport	1.Flow can be regulated 2. Production of energy is instant 3. Readily available 4. Not as dirty as solid fuel 5. More friendly	1.Easy to handle 2.Saves a lot of labour 3.Controllable through regulators 4.Very little pollution 5.Instant fuel	1.Easy to operate 2.Fuel is clean 3.No storage required 4.Efficiency is good 5.Eco-friendly

Disadvantages	1.Requires space 2.Heat cannot be controlled 3.Pollutes the environment 4.Causes health hazard 5.Ignition time is high 6. More labour required to operate 7.Not eco-friendly	1.Requires space 2.Lot of care to be taken 3.Releases pollution 4.Sources are not reliable in terms of purity 5.Bad odour	1.Transportaion cost is high because of high volatility 2.Regular check of equipment and supply line required 3.Lot of care by an expert required 4. Very large storage tanks are needed. 5.Highly inflammable	1.Expert required to handle the equipment 2.Chances if short circuit 3.It is costly 4.Risk of shock 5.Cost of maintenance is high.

Calorific values of solid, liquid and gaseous fuels

By custom the basic calorific value for solid and liquid fuels is the gross calorific value at constant volume and for gaseous fuels it is the gross calorific value at constant pressure. The word 'gross' here signifies that the water formed and liberated during combustion is in the liquid phase. The values given are approximate because many of the substances listed are not well defined.

The calorific value of a fuel is the **quantity of heat produced by its combustion** - at constant pressure and under "normal" ("standard") conditions (i.e. to 0^oC and under a pressure of *1,013 mbar*).

The combustion process generates water vapour and certain techniques may be used to recover the quantity of heat contained in this water vapour by condensing it.

- *Higher Calorific Value* (or Gross Calorific Value - GCV, or Higher Heating Value - HHV) - the water of combustion is entirely condensed and that the heat contained in the water vapour is recovered
- *Lower Calorific Value* (or Net Calorific Value - NCV, or Lower Heating Value - LHV) - the products of combustion contains the water vapour and that the heat in the water vapour is not recovered

Fuel	Higher Calorific Value (Gross Calorific Value - GCV)		Lower Calorific Value (Net Calorific Value - NCV)
	kJ/kg	***Btu/lb***	***kJ/kg***
Acetone	29000		
Alcohol 96%	30000		
Anthracite	32500 - 34000	14000 - 14500	
Bituminous coal	17000 - 23250	7300 - 10000	
Butane	49510	20900	45750
Carbon	34080		
Charcoal	29600	12800	
Coal (Lignite - Anthrasite)	15000 - 27000	8000 - 14000	
Coke	28000 - 31000	12000 - 13500	
Diesel fuel	44800	19300	43400
Ethane	51900		47800
Ethanol	29700	12800	
Ether	43000		
Gasoline	47300	20400	44400

Fuel	Higher Calorific Value (Gross Calorific Value - GCV)		Lower Calorific Value (Net Calorific Value - NCV)
	kJ/kg	***Btu/lb***	***kJ/kg***
Glycerin	19000		
Hydrogen	141790	61000	121000
Kerosene	46200		43000
Lignite	16300	7000	
Methane	55530		50000
Methanol	23000		
Oil, heavy fuel	43000		
Oil, light destilate	48000		
Oil, light fuel	44000		
Oils vegetable	39000 - 48000		
Paraffin	46000		41500
Peat	13800 - 20500	5500 - 8800	
Pentane			45350

Fuel	Higher Calorific Value (Gross Calorific Value - GCV)		Lower Calorific Value (Net Calorific Value - NCV)
	kJ/kg	***Btu/lb***	***kJ/kg***
Petrol	48000		
Petroleum	43000		
Propane	50350		46350
Semi anthracite	26700 - 32500	11500 - 14000	
Sulfur	9200		
Tar	36000		
Turpentine	44000		
Wood (dry)	14400 - 17400	6200 - 7500	
	kJ/m^3	*Btu/ft^3*	
Acetylene	56000		
Butane C_4H_{10}	133000	3200	
Hydrogen	13000		
Natural gas	43000	950 - 1150	
Methane CH_4	39820		

Fuel	Higher Calorific Value (Gross Calorific Value - GCV)		Lower Calorific Value (Net Calorific Value - NCV)
	kJ/kg	***Btu/lb***	***kJ/kg***
Propane C_3H_8	101000	2550	
Town gas	18000		
	kJ/l	*Btu/Imp gal*	
Gas oil	38000	164000	
Heavy fuel oil	41200	177000	
Kerosene	35000	154000	

- *1 kJ/kg = 1 J/g = 0.4299 Btu/ lb_m = 0.23884 kcal/kg*
- *1 Btu/lb_m = 2.326 kJ/kg = 0.55 kcal/kg*
- *1 kcal/kg = 4.1868 kJ/kg = 1.8 Btu/lb_m*
- *1 dm^3 (Liter) = 10^{-3} m^3 = 0.03532 ft^3 = 1.308x10^{-3} yd^3 = 0.220 Imp gal (UK) = 0.2642 Gallons (US)*

9.5 Calculation of fuel amount and its cost:

In hotels, various fuels may be required. Amount of solid fuels are measured by their weight and Liquid fuels, gaseous fuels and electric energy through meter. By knowing amount of fuels used during a period, say a month and then by knowing the unit cost of fuels the fuel cost for a month may be found and thus average expenditure on fuels in hotel can be calculated. Let us take simple example regarding cost of fuel in the catering section of a hotel. Say in a hotel 120-gas cylinders used average per year in catering section. Cost per cylinder is Rs. 200/-.

To determine average cost of gas fuel per month for said catering section-

Cost of gas fuel for one year = 120 x200 = Rs. 24,000

Per month 24000/12 = Rs. 2000/-

Fuel cost economy:

To keep the cost at economic level in catering industry the kitchen energy saving will play very important role. Few tips given below in this regard. For food disposer it is better to use cold water instead of hot water. That saves fuel required for hot water. Greased solidify in cold water, can be ground and washed easily. Kitchen sink faucet may be fitted with aerator to reduce hot water flow and save fuel for hot water. Gas burner needs burn with blue flame. Has to be cleaned time to time. Water to be boiled in kettle or covered pans in place of open ones. Matching the size of pan to heating element will reduce heat lost to surrounding air. In case of oven-cooked meals, it is better to cook as many dishes as can be managed at a time. In case of cooking food with electricity, the burners are to be turned off several minutes before necessary cooking time as heating element will stay hot long enough of finish up cooking and that will save electricity. Not to open oven doors often to check food inside. To use small pans or ovens for small meals. Use of pressure cooker and microwave oven can save fuel.

GAS

Heat: is a form of energy. Can be converted to other forms of energy i.e. steam, mechanical etc.

Temperature: indicates "hotness". Is a measure of intensity of heat.

Heat units: B.T.U. (British thermal unit)

C.H.U. (centesimal heat unit)

Cal (Calorie) etc.

1 Kcal = 2.21 CHU = 3.97 BTU.

1BTU = 0.556CHU = 0.252 Kcal

Heat transfer: can be transferred by Convection, Conduction and Radiation.

Principles of Bunsen burner:

It was Robert Bunsen, a German chemist who introduced the burner. It works on the principle on which gas is now used in stoves and lights. By arranging more supply of air to the gas fuel perfect combustion resulted inside the burner. The non-luminous flame of burner is the outside edge of the outer cone.

High and low, pressure burners: Burners may be of high and low pressure gas supply type. Maximum pressure is 14 inches water column pressure. Heat output depends on pressure.

Low pressure: 4-inch water column. Equivalent to 18,000 BTU/ hr.

High pressure: 10 inch water column. Equivalent to 16,000 BTU/hr.

Therefore, low-pressure burners out put more than high-pressure ones.

Precautions to be taken while handling gas:

Obviously one has to be careful in handling gas fuel. The valves fitted in pipes and tank must be operated in rational manner. When fuel not in use these valves must be kept closed. Leakage of gas in any manner is dangerous. Flame and fire to be kept at safe distance. Abnormal odour to be verified as soon as possible. Pressure regulator function to be observed, tested, and replaced when necessary.

Fuel tanks, location, manifold types:

Oil fuel tanks may be inside or outside the building. Outside tanks are located underground. Normally following procedure of installation to be maintained for fuel oil tanks-Tanks installed as close as possible to the inside wall, either at front of building or at the side adjacent to drive way for allowing easy access for filling of fuel. Tank to be located to provide for shortest possible pipe connection, from tank to burner, but at the same time it must not be less than minimum distance required from burners or source of any other fire or flame. Tank to be provided for shortest fill connection as far as practicable.

Manifold: firing end of burner consists of gas manifold assembly (for gas burners) that includes the mounting flange for the whole burner. The assembly can be rotated 120O to provide for right or left hand entrance. It is to be noted that if gas tank installed outside then these to be underground installations talking all safety measures against fire and undesirable explosion danger. Water spray arrangements should be provided to prevent excessive heat of summer, which may cause explosion.

9.6 Review Questions

1. How many types of fuel used in catering industry?
2. Explain the calorific value of fuels?
3. Define the comparative study of different fuels?
4. What is the Calculation of amount of fuel required and cost?
5. Explain the Principles of Bunsen burner?

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UNIT 10

FIRE

10.1 Introduction

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light, and various reaction products. Slower oxidative processes like rusting or digestion are not included by this definition.

The *flame* is the visible portion of the fire. If hot enough, the gases may become ionized to produce plasma. Depending on the substances alight, and any impurities outside, the color of the flame and the fire's intensity will be different.

Fire in its most common form can result in conflagration, which has the potential to cause physical damage through burning. Fire is an important process that affects ecological systems around the globe. The positive effects of fire include stimulating growth and maintaining various ecological systems. Fire has been used by humans for cooking, generating heat, light, signaling, and propulsion purposes. The negative effects of fire include hazard to life and property, atmospheric pollution, and water contamination. If fire removes protective vegetation, heavy rainfall may lead to an increase in soil erosion by water. Also, when vegetation is burned,

the nitrogen it contains is released into the atmosphere, unlike elements such as potassium and phosphorus which remain in the ash and are quickly recycled into the soil. This loss of nitrogen caused by a fire produces a long-term reduction in the fertility of the soil, which only slowly recovers as nitrogen is "fixed" from the atmosphere by lightning and by leguminous plants such as clover.

Fires start when a flammable or a combustible material, in combination with a sufficient quantity of an oxidizer such as oxygen gas or another oxygen-rich compound (though non-oxygen oxidizers exist), is exposed to a source of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to sustain a rate of rapid oxidation that produces a chain reaction. This is commonly called the fire tetrahedron. Fire cannot exist without all of these elements in place and in the right proportions. For example, a flammable liquid will start burning only if the fuel and oxygen are in the right proportions. Some fuel-oxygen mixes may require a catalyst, a substance that is not consumed, when added, in any chemical reaction during combustion, but which enables the reactants to combust more readily.

Once ignited, a chain reaction must take place whereby fires can sustain their own heat by the further release of heat energy in the process of combustion and may propagate, provided there is a continuous supply of an oxidizer and fuel.

If the oxidizer is oxygen from the surrounding air, the presence of a force of gravity, or of some similar force caused by acceleration, is necessary to produce convection, which removes combustion products and brings a supply of oxygen to the fire. Without gravity, a fire rapidly surrounds itself with its own combustion products and non-oxidizing gases from the air, which exclude oxygen and extinguish the fire. Because of this, the risk of fire in a spacecraft is small when it is coasting in inertial flight. Of course, this does not apply if oxygen is supplied to the fire by some process other than thermal convection.

Fire can be extinguished by removing any one of the elements of the fire tetrahedron. Consider a natural gas flame, such as from a stovetop burner. The fire can be extinguished by any of the following:

- turning off the gas supply, which removes the fuel source;
- covering the flame completely, which smothers the flame as the combustion both uses the available oxidizer (the oxygen in the air) and displaces it from the area around the flame with CO_2;
- application of water, which removes heat from the fire faster than the fire can produce it (similarly, blowing hard on a flame will displace the heat of the currently burning gas from its fuel source, to the same end), or
- application of a retardant chemical such as Halon to the flame, which retards the chemical reaction itself until the rate of combustion is too slow to maintain the chain reaction.

In contrast, fire is intensified by increasing the overall rate of combustion. Methods to do this include balancing the input of fuel and oxidizer to stoichiometric proportions, increasing fuel and oxidizer input in this balanced mix, increasing the ambient temperature so the fire's own heat is better able to sustain combustion, or providing a catalyst; a non-reactant medium in which the fuel and oxidizer can more readily react.

10.2 Facts about fire –

(a) Fire is exothermic reaction.
(b) Fire is a process of burning.

Chemical reaction is initiated by presence of heat energy in which a sub-stance combines with oxyzen of the air, the process accomplishing by emission of energy in the form of heat, light, & sound.

Following are essential for fire –

(i) A combustible substance – fuel
(ii) Oxygen, chlorine, Nitrogen, (Magnesium burns in Nitrogen)
(iii) Heat source- spark, flame.

(iii) Process of chain reaction.

Flash point & fire point are properties of fuel concerning to ignition & burning –

FLASH POINT- It is the lowest temperature at which the fuel gives off enough vapours that ignite for a moment when a small flame is brought near to it.

FIRE POINT – It is the lowest temperature at which the vapours of the fuel burn continuously for at least 5 second when a tiny flame is brought near to it.

In most cases the fire points are $5^{o}C$ to $40^{o}C$ higher than the flash points.

Most of the objects starts burning when their self ignition temperature is reached.

HOW DO THESE FIRES START ?

Fires starts due to-

(i) Cigarettes, smoking materials falling asleep.

(ii) Arson – fires set deliberately

(iii) Kitchen fires.

(iv) Electrical distribution fires.

10.3 TYPES OF COMBUSTION

(i) Rapid- Gas is ignited, Produces heat & light

(ii) Spontaneous without the application of any external heat.

(iii) Explosion - Combustion in confined place under pressure, heat & light is produced.

Development of fire –

(i) Flash over- Element has been preheated.

(ii) Small point fire smouldering.

Stage of fires –

(i) Incipient stage - Preheating & gasification (slow pyrolysis) is in progress. Invisible pyrolysis produes gas.

Submicron size- Aerosols (tiny particles) are found in the vicinity of fire. Immunicron chamber is used to detect these tiny particles

(ii) Smouldering stage – Lasting for 4 hours- gas & smoke.

Fully developed pyrolysis begins with ignition, initial stage of combustion. Invisible aerosol. Visible smoke.

(iii) Radiation Convective heat.

(iv) **Heat stage-** heat, flame, smoke, toxic gas – for few seconds.

10.4 Classifications of Fire

Class A	Ordinary combustibles	Class A fires consist of ordinary combustibles such as wood, paper, fabric, plastic, and most kinds of trash.
Class B	Flammable liquid	
Class C	Flammable gas	
Class D	Combustible metals	Class D fires consist of combustible metals such as magnesium, potassium, titanium, and zirconium
CLASS E	Electrical fires	Electrical fires are fires involving potentially energized electrical equipment.

CLASS F	Cooking oils and fats (kitchen fires)	
TYPE	EXTINGUISHER	

Class E has been discontinued, but covered fires involving electrical appliances. This is no longer used on the basis that, when the power supply is turned off, an electrical fire can fall into any of the remaining five categories.

Type	**Old code**	**Suitable for use on fire classes (brackets denote sometimes applicable)**					
Water	Signal red	A					
Foam	Cream	A	B				
Dry powder	French blue	(A)	B	C		E	
Carbon dioxide CO_2	Black		B			E	
Wet chemical	Not yet in use	A	(B)				F
Class D powder	French blue				D		
Halon 1211/BCF	Emerald Green	A	B			E	

CLASS A	Water
CLASS B	These fires follow the same basic fire tetrahedron (heat, fuel, oxygen, chemical reaction) as ordinary combustible fires, except that the fuel in question is a flammable liquid such as gasoline, or gas such as natural gas. A solid stream of water should never be used to extinguish this type because it can cause the fuel to scatter, spreading the flames. The most effective way to extinguish a liquid or gas fueled fire is by inhibiting the chemical chain reaction of the fire, which is done by dry chemical and Halon extinguishing agents, although smothering with CO_2 or, for liquids, foam is also effective.
CLASS C	This sort of fire may be caused by short-circuiting machinery or overloaded electrical cables. These fires can be a severe hazard to firefighters using water or other conductive agents: Electricity may be conducted from the fire, through water, to the firefighter's body, and then earth. Electrical shocks have caused many firefighter deaths. Electrical fire may be fought in the same way as an ordinary combustible fire, but water, foam, and other conductive agents are not to be used. While the fire is or possibly could be electrically energized, it can be fought with any extinguishing agent rated for electrical fire.
CLASS D	With the exception of the metals that burn in contact with air or water (for example, sodium), masses of combustible metals do not represent unusual fire risks because they have the ability to conduct heat away from hot spots so efficiently that the heat of combustion cannot be maintained—this means that it will require a lot of heat to ignite a mass of combustible metal. Generally, metal fire risks exist when sawdust, machine shavings and other metal 'fines' are present. Generally, these fires can be ignited by the same types of ignition sources that would start other common fires. Dry powder agents work by smothering and heat absorption. The most common of these agents are sodium chloride granules and graphite powder. In recent years powdered copper has also come into use. Only dry powder should ever be used to extinguish a metal fire.
CLASS F	Fires that involve cooking oils or fats are designated "Class K" under the American system, and "Class F" under the European/Australasian systems. Though such fires are technically a subclass of the flammable liquid/gas class, the special characteristics of these types of fires, namely the higher flash point, are considered important enough to recognize separately. Watermist can be used to extinguish such fires. Appropriate fire extinguishers may also have hoods over them that help extinguish the fire.

10.5 Fire Extinguisher

Fire extinguisher, or **extinguisher**, is an active fire protection device used to extinguish or control small fires, often in emergency situations. It is not intended for use on an out-of-control fire, such as one which has reached the ceiling, endangers the user (i.e., no escape route, smoke, explosion hazard, etc.), or otherwise requires the expertise of a fire department. Typically, a fire extinguisher consists of a hand-held cylindrical pressure vessel containing an agent which can be discharged to extinguish a fire.

10.5.1 Working of Fire Extinguisher

There are two main types of fire extinguishers: stored pressure and cartridge-operated. In stored pressure units, the expellant is stored in the same chamber as the firefighting agent itself. Depending on the agent used, different propellants are used. With dry chemical extinguishers, nitrogen is typically used; water and foam extinguishers typically use air. Stored pressure fire extinguishers are the most common type. Cartridge-operated extinguishers contain the expellant gas in a separate cartridge that is punctured prior to discharge, exposing the propellant to the extinguishing agent. This type is not as common, used primarily in areas such as industrial facilities, where they receive higher-than-average use. They have the advantage of simple and prompt recharge, allowing an operator to discharge the extinguisher, recharge it, and return to the fire in a reasonable amount of time. Unlike stored pressure types, these extinguishers use compressed carbon dioxide instead of nitrogen, although nitrogen cartridges are used on low temperature

Fire extinguishers are further divided into handheld and cart-mounted, also called wheeled extinguishers. Handheld extinguishers weigh from 0.5 to 14 kilograms (1.1 to 30.9 lb), and are hence, easily portable by hand. Cart-mounted units typically weigh more than 23 kilograms (51 lb). These wheeled models are most commonly found at construction sites, airport runways, heliports, as well as docks and marinas.

10.5.2 History

The first fire extinguisher of which there is any record was patented in England in 1723 by Ambrose Godfrey, a celebrated chemist at that time. It consisted of a cask of fire-extinguishing liquid containing a pewter chamber of gunpowder. This was connected with a system of fuses which were ignited, exploding the gunpowder and scattering the solution. This device was probably used to a limited extent, as Bradley's Weekly Messenger for November 7, 1729, refers to its efficiency in stopping a fire in London.

The modern fire extinguisher was invented by British Captain George William Manby in 1818; it consisted of a copper vessel of 3 gallons(13.6 liters) of pearl ash (potassium carbonate) solution contained within compressed air.

A classic copper building type soda-acid extinguisher

The soda-acid extinguisher was first patented in 1866 by Francois Carlier of France, which mixed a solution of water and sodium bicarbonate with tartaric acid, producing the propellant CO_2 gas. A soda-acid extinguisher was patented in the U.S. in 1881 by Almon M. Granger. His extinguisher used the reaction between sodium bicarbonate solution and sulfuric acid to expel pressurized water onto a fire. A vial of concentrated sulfuric acid was suspended in the cylinder. Depending on the type of extinguisher, the vial of acid could be broken in one of two ways. One used a plunger to break the acid vial, while the second released a lead stopple that held the vial closed. Once the acid was mixed with the bicarbonate solution, carbon dioxide gas was expelled and thereby pressurized the water. The pressurized water was forced from the canister through a nozzle or short length of hose.

The cartridge-operated extinguisher was invented by Read & Campbell of England in 1881, which used water or water-based solutions. They later invented a carbon tetrachloride model called the "Petrolex" which was marketed toward automotive use.[2]

A glass "grenade" style extinguisher, to be thrown into a fire.

The chemical foam extinguisher was invented in 1904 by Aleksandr Loran in Russia, based on his previous invention of fire fighting foam. Loran first used it to extinguish a pan of burning naphtha.[3]It worked and looked similar to the soda-acid type, but the inner parts were slightly different. The main tank contained a solution of sodium bicarbonate in water, whilst the inner container (somewhat larger than the equivalent in a soda-acid unit) contained a solution of aluminium sulphate. When the solutions were mixed, usually by inverting the unit, the two liquids reacted to create a frothy foam, and carbon dioxide gas. The gas expelled the foam in the form of a jet. Although liquorice-root extracts and similar compounds were used as additives (stabilizing the foam by reinforcing the bubble-walls), there was no "foam compound" in these units. The foam was a combination of the products of the chemical reactions: sodium and aluminiumsalt-gels inflated by the carbon dioxide. Because of this, the foam was discharged directly from the unit, with no need for an aspirating branch pipe (as in newer foam-compound types).

Another type of carbon tetrachloride extinguisher was the **fire grenade**. This consisted of a glass sphere filled with CTC, that was intended to be hurled at the base of a fire (early ones used salt-water, but CTC was more effective). Carbon tetrachloride was suitable for liquid and electrical

fires and the extinguishers were fitted to motor vehicles. Carbon tetrachloride extinguishers were withdrawn in the 1950s because of the chemical's toxicity - exposure to high concentrations damages the nervous system and internal organs. Additionally, when used on a fire, the heat can convert CTC to phosgene gas, formerly used as a chemical weapon.

In the 1940s, Germany invented the liquid chlorobromomethane (CBM) for use in aircraft. It was more effective and slightly less toxic than carbon tetrachloride and was used until 1969. Methyl bromide was discovered as an extinguishing agent in the 1920s and was used extensively in Europe. It is a low-pressure gas that works by inhibiting the chain reaction of the fire and is the most toxic of the vaporizing liquids, used until the 1960s. The vapor and combustion by-products of all vaporizing liquids were highly toxic, and could cause death in confined spaces.

A chemical foam extinguisher with contents.

The carbon dioxide (CO_2) extinguisher was invented by the Walter Kidde Company in 1924 in response to Bell Telephone's request for an electrically non-conductive chemical for extinguishing the previously difficult-to-extinguish fires in telephone switchboards. It consisted of a tall metal cylinder containing 7.5 pounds (3.4 kg) of CO_2 with a wheel valve and a woven brass, cotton covered hose, with a composite funnel-like horn as a nozzle. CO_2 is still popular today as it is an ozone-friendly clean agent and is used heavily in film and television production to extinguish burning stuntmen.[8] Carbon dioxide extinguishes fire mainly by displacing oxygen. It was once thought that it worked by cooling, although this effect on most fires is negligible. This characteristic is well known and has led to the widespread misuse of carbon dioxide extinguishers to rapidly cool beverages, especially beer.

An early dry chemical extinguisher, the first ones had copper cylinders, this one is steel.

In 1928, DuGas came out with a cartridge-operated dry chemical extinguisher, which used sodium bicarbonate specially treated with chemicals to render it free-flowing and moisture-resistant. It consisted of a copper cylinder with an internal CO_2cartridge. The operator turned a wheel valve on top to puncture the cartridge and squeezed a lever on the valve at the end of the hose to discharge the chemical. This was the first agent available for large-scale three-dimensional liquid and pressurized gas fires, and was but remained

largely a specialty type until the 1950s, when small dry chemical units were marketed for home use. ABC dry chemical came over from Europe in the 1950s, with Super-K being invented in the early 60s and Purple-K being developed by the US Navy in the late 1960s.

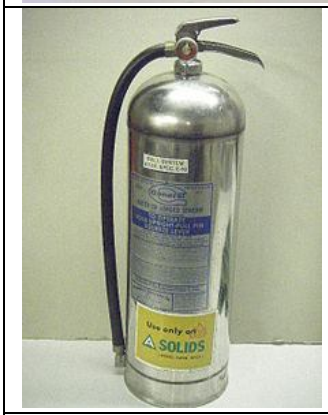
10.6 Types of extinguishing agents

10.6.1 Dry chemical

	A small, disposable sodium bicarbonate dry chemical unit intended for home kitchen use.
	A typical dry chemical extinguisher containing 5 lb (2.3 kg). of ammonium phosphate dry chemical
	A 20 lb (9.1 kg) US Navy cartridge-operated purple-K dry chemical (potassium bicarbonate) extinguisher. `
	Two Super-K (potassium chloride) extinguishers. This is a powder based agent that extinguishes by separating the four parts of the fire tetrahedron. It prevents the chemical reactions involving heat, fuel, and oxygen and halts the production of fire sustaining "free-radicals", thus extinguishing the fire.
Monoammonium phosphate, also known as "tri-class", "multipurpose" or "ABC" dry chemical,	Monoammonium phosphate, also known as "tri-class", "multipurpose" or "ABC" dry chemical, used on class A, B, and C fires. It receives its class A rating from the agent's ability to melt and flow at 177 °C (350 °F) to smother the fire. More corrosive than other dry chemical agents. Pale yellow in color.
Sodium bicarbonate, "regular" or "ordinary"	Sodium bicarbonate, "regular" or "ordinary" used on class B and C fires, was the first of the dry chemical agents developed. In the heat

	of a fire, it releases a cloud of carbon dioxide that smothers the fire. That is, the gas drives oxygen away from the fire, thus stopping the chemical reaction. This agent is not generally effective on class A fires because the agent is expended and the cloud of gas dissipates quickly, and if the fuel is still sufficiently hot, the fire starts up again. While liquid and gas fires do not usually store much heat in their fuel source, solid fires do. Sodium bicarbonate was very common in commercial kitchens before the advent of wet chemical agents, but now is falling out of favor, as it is much less effective than wet chemical agents for class K fires, less effective than Purple-K for class B fires, and is ineffective on class A fires. White or blue in color.
Potassium bicarbonate	Potassium bicarbonate (principal constituent of Purple-K), used on class B and C fires. About two times as effective on class B fires as sodium bicarbonate, it is the preferred dry chemical agent of the oil and gas industry.
Foam-Compatible	Foam-Compatible, which is a sodium bicarbonate (BC) based dry chemical, was developed for use with protein foams for fighting class B fires. Most dry chemicals contain metal stearates to waterproof them, but these will tend to destroy the foam blanket created by protein (animal) based foams. Foam compatible type uses silicone as a waterproofing agent, which does not harm foam. Effectiveness is identical to regular dry chemical, and it is light green in color (some ANSUL brand formulations are blue). This agent is generally no longer used since most modern dry chemicals are considered compatible with synthetic foams such as AFFF.
	A class D fire extinguisher for various metals

10.6.2 Foam Based

	A 2½ gallon AFFF foam fire extinguisher AFFF (Aqueous Film Forming Foam), used on A and B fires and for vapor suppression. The most common type in portable foam extinguishers. It contains fluoro tensides which can be accumulated in the human body. The long-term effects of this on the human body and environment are unclear at this time.
	An American water extinguisher AR-AFFF (Alcohol-Resistant Aqueous Film Forming Foams), used on fuel fires containing alcohol. Forms a membrane between the fuel and the foam preventing the alcohol from breaking down the foam blanket.
FFFP (film forming fluoroprotein)	FFFP (film forming fluoroprotein) contains naturally occurring proteins from animal by-products and synthetic film-forming agents to create a foam blanket that is more heat resistant than the strictly synthetic AFFF foams. FFFP works well on alcohol-based liquids and is used widely in motorsports. Applied to fuel fires as either an aspirated (mixed & expanded with air in a branch pipe) or nonaspirated form to form a frothy blanket or seal over the fuel, preventing oxygen reaching it. Unlike powder, foam can be used to progressively extinguish fires without flashback.
CAFS (compressed air foam system)	CAFS (compressed air foam system) Any APW style extinguisher that is charged with a foam solution and pressurized with compressed air. Generally used to extend a water supply in wild land operations. Used on class A fires and with very dry foam on class B for vapor suppression.
Cold Fire	Cold Fire, is an organic, eco-friendly wetting agent that

	works to take the heat out of fire by breaking down heat hydrocarbons. Bulk Cold Fire is used in booster tanks and is acceptable for use in CAFS systems. Cold Fire is UL listed and is effective against class A,B,D and K fires. Aerosol versions are preferred by users for cars, boats, RV's, and kitchens.

10.6.3 Water :- Cools burning material.

APW (Air pressurized water)	APW (Air pressurized water) cools burning material by absorbing heat from burning material. Effective on class A fires, it has the advantage of being inexpensive, harmless, and relatively easy to clean up. In the United States, APW units contain 2.5 gallons (9 liters) of water in a tall, stainless steel cylinder. In India, they are typically mild steel lined with polyethylene, painted red, containing 6–9 liters (1.75–2.5 gallons) of water.
Water Mist	Water Mist uses a fine misting nozzle to break up a stream of deionized water to the point of not conducting electricity back to the operator. Class A and C rated. It is used widely in hospitals for the reason that, unlike other clean-agent suppressants, it is harmless and non-contaminant. These extinguishers come in 1.75 and 2.5 gallon units, painted white in the United States and red in India.

10.6.4 For Class D

	A class D fire extinguisher for various metals
Sodium chloride	Sodium chloride contains sodium chloride salt, which melts to form an oxygen-excluding crust over the metal. Useful on most alkali

	metals including sodium and potassium, and other metals includin magnesium, titanium, aluminum, and zirconium.
Copper based	Copper based developed by the U.S. Navy in the 70s. Powder smothers and acts as a heat sink to dissipate heat, but also forms a copper-lithium alloy on the surface which is non-combustible and cuts off the oxygen supply. Will cling to a vertical surface. Lithium only.
Sodium carbonate-based	Sodium carbonate-based used where stainless steel piping and equipment could be damaged by sodium chloride based agents to control sodium, potassium, and sodium-potassium alloy fires. Limited use on other metals. Smothers and forms a crust.

Most class D extinguishers will have a special low velocity nozzle or discharge wand to gently apply the agent in large volumes to avoid disrupting any finely divided burning materials. Agents are also available in bulk and can be applied with a scoop or shovel.

10.6.5 Some other types of Extinguishers

Fire extinguishing ball	Several modern ball or "grenade" style extinguishers are on the market. They are manually operated by rolling or throwing into a fire. The modern version of the ball will self-destruct once in contact with flame, dispersing a cloud of ABC dry chemical powder over the fire which extinguishes the flame. The coverage area is about 5 square meters. One benefit of this type is that it may be used for passive suppression. The ball can be placed in a fire prone area and will deploy automatically if a fire develops, being triggered by heat. Most modern extinguishers of this type are designed to make a loud noise upon deployment.
Condensed aerosol fire suppression	Condensed aerosol fire suppression is a particle-based form of fire extinction similar to gaseous fire suppression or dry chemical fire extinction. As with gaseous fire suppressants, condensed aerosol suppressants use clean agents to suppress the fire. The agent can be delivered by means of mechanical operation, electric operation, or combined electro-mechanical operation. To the difference of gaseous suppressants, which emit only gas, and dry chemical extinguishers, which release powder-like particles of a large size (25-150 μm) condensed aerosols are defined by the National Fire Protection Association as releasing finely divided solid particles (generally <10 μm), usually in addition to gas.

10.7 Summary

Fire in its most common form can result in conflagration, which has the potential to cause physical damage through burning. Fire is an important process that affects ecological systems around the globe. The positive effects of fire include stimulating growth and maintaining various ecological systems. Fire has been used by humans for cooking, generating heat, light, signaling, and propulsion purposes

We Know that

Fuel + Oxygen + Heat = Fire

Fire takes place when fuel is ignited.

Source of ignition.

Heat which can be produced by – Friction, Electricity.

Heat is also responsible for spreading fire. Fuel burnt by oxidation with production of heat & product of combustion.

10.8 Review Questions

Q1 Write a short note on Fire.

Q2 Discuss Flash Point and Fire Point.

Q3 What are the various stages of Fire? Discuss

Q4 Classify Fire and Briefly describe each of them.

Q5 Explain Fire extinguishers? Discuss extinguishers used in metallic fires.

Q6 Discuss Dry Chemical Based Fire Extinguishers.

10.9. Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 11

WATER SYSTEM

Structure

11.0 Introduction

Water is a transparent fluid which forms the world's streams, lakes, oceans and rain, and is the major constituent of the fluids of living things. As a chemical compound, a water molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Water is a liquid at standard ambient temperature and pressure, but it often co-exists on Earth with its solid state, ice; and gaseous state, steam (water vapor).

Water covers 71% of the Earth's surface. It is vital for all known forms of life. On Earth, 96.5% of the planet's water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and the

ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation. Only 2.5% of the Earth's water is freshwater, and 98.8% of that water is in ice and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products.

11.1 Importance of Water

Next to air, the other important requirement , for human life to exit is water. It is essential for life, health and sanitation. It is the principal raw material for food production. It is needed for drinking, washing of hand, face, fllors,washing, fountain , heating air conditioning, swimming pool.air cooler, brewing, coffee, cleaning of equipments, utenils, ice making Fire fighting etc.

In hotels water requirement is 180 Lit/bed/day. In restaurant water requirement is 70 lit/seat/day.

Humans require water with few impurities. Common impurities include metal salts and oxides, including copper, iron, calcium and lead, and/or harmful bacteria, such as Vibrio. Some solutes are acceptable and even desirable for taste enhancement and to provide needed electrolytes

The single largest (by volume) freshwater resource suitable for drinking is Lake Baikal in Siberia.

11.2 Uses of Water

Washing

The property of water to form solutions and emulsions is useful in various washing processes. Many industrial processes rely on reactions using chemicals dissolved in water, suspension of solids in water slurries or using water to dissolve and extract substances. Washing is also an important component of several aspects of personal body hygiene.

Transportation

The use of water for transportation of materials through rivers and canals as well as the international shipping lanes is an important part of the world economy.

Chemical uses

Water is widely used in chemical reactions as a solvent or reactant and less commonly as a solute or catalyst. In inorganic reactions, water is a common solvent, dissolving many ionic compounds. In organic reactions, it is not usually used as a reaction solvent, because it does not

dissolve the reactants well and is amphoteric (acidic *and* basic) and nucleophilic. Nevertheless, these properties are sometimes desirable.

Heat exchange

Water and steam are a common fluid used for heat exchange, due to its availability and high heat capacity, both for cooling and heating. Cool water may even be naturally available from a lake or the sea. It's especially effective to transport heat through vaporization and condensation of water because of its large latent heat of vaporization. A disadvantage is that metals commonly found in industries such as steel and copper are oxidized faster by untreated water and steam. In almost all thermal power stations, water is used as the working fluid (used in a closed loop between boiler, steam turbine and condenser), and the coolant (used to exchange the waste heat to a water body or carry it away by evaporation in a cooling tower). In the United States, cooling power plants is the largest use of water.

Fire extinction

Water is used for fighting wildfires.

Water has a high heat of vaporization and is relatively inert, which makes it a good fire extinguishing fluid. The evaporation of water carries heat away from the fire. It is dangerous to use water on fires involving oils and organic solvents, because many organic materials float on water and the water tends to spread the burning liquid.

Use of water in fire fighting should also take into account the hazards of a steam explosion, which may occur when water is used on very hot fires in confined spaces, and of a hydrogen explosion, when substances which react with water, such as certain metals or hot carbon such as coal, charcoal, or coke graphite, decompose the water, producing water gas.

The power of such explosions was seen in the Chernobyl disaster, although the water involved did not come from fire-fighting at that time but the reactor's own water cooling system. A steam explosion occurred when the extreme overheating of the core caused water to flash into steam. A hydrogen explosion may have occurred as a result of reaction between steam and hot zirconium.

Recreation

Humans use water for many recreational purposes, as well as for exercising and for sports. Some of these include swimming, waterskiing, boating, surfing and diving. In addition, some sports, like ice hockey and ice skating, are played on ice. Lakesides, beaches and water parks are popular places for people to go to relax and enjoy recreation. Many find the sound and appearance of flowing water to be calming, and fountains and other water features are popular decorations. Some keep fish and other life in aquariums or ponds for show, fun, and companionship. Humans also use water for snow sports i.e. skiing, sledding, snowmobiling or snowboarding, which require the water to be frozen.

11.3 Sources of Water Supply:

The chief sources of all water supply is rainfall. This water after getting proper treatment we get from municipal corporation/water supply department i.e. public health engg. Department.Other source of water underground water. Water that has percolated into the ground is brought on the surface.The upper surface of free water in the top soil is termed as ground water level/table. Infiltration wells are sunk in series on the bank of river.

Other Source is spring an outcrops of water. A ground well is defined as an artificial hole/pit made in the ground for the purpose of tapping of water.

11.3.1 Tube Wells-

Tube wells are of type-

(a) Strainer type
(b) Cavity type
(c) Slotted type
(d) Perforated type.

Tube wells- bores are made in to the ground by hand & Mechanically operated augers, percussion equipment or drilled by coring rigs.

The most common bores are made by augers in which a pipe is inserted on a hand pump with a suction pipe is installed. Hand pumps are for local use and the wells are exposed to the same pollution risks as the dug wells.

A more scientific deep-bore hand pump called Mark IV, for drawing safe water from deeper strata, has been developed by Indian Scientists, and is now being extensively used in rural water supply schemes in India,.

Tubewells deeper than 30 m or so have a lesser chance of being polluted. The possibility of contamination in any tubewell should never be discounted and water should be tested often to ensure safety.

Tube well is deep well having diameter 50 to 200 mm.

A bore is drilled in the ground (Percussion core rotary drilling m/c.) For testing the yields of a well recuperation and constant pumping test is done, pipe for tube well is then inserted in the bore hole. It consist of strainer and blind sections. A strainer is a perforated pipe which is provided with an arrangement such as that only water will be admitted to inside of the pipe. Pumping is then started.

Maintenance Of A Tube Well :

Use in the grounds and gardens, then it is essential to ensure that there is no possibility of the contamination of potable water supplies with these lower-qual-ity supplies, The two systems must be physically isolated and outlet points with non-potable' supplies must be clearly labeled as not suitable for drinking.

(i) Cleaning of screen with hydro sulfuric acid. Hydrochloric acid.
(ii) Removal of lime particles – clogging of screen.
(iii) Replacement of parts.

Failure of tube well is due to

(i) Corrosion
(ii) Incrustation – deposition of alkali salts on the inside walls of the tube well.

11.3.2. Types Of Well Construction :

(a) Dug well – Shallow well.

(b) Driven well – Deep well in unconsolidated solid.

(c) Bored/Drilled well.

11.3.3. Sanitary Protection Of Well :

(a) Water tight connection of pump.

(b) Covered top.

(c) Casing depth 3m below the ground water table.

(d) Distance from the source of contamination, minimum 90m.

(e) No presence of trees.

(f) Priming of pump by safe water.

(g) Washing of cloth should be prohibited.

Other Sources

- **Open Streams/Springs Etc**
- **Rain Water Harvesting :**
- **Rivers**
- **Lakes (Natural And Artificial) :**
- **Oceans**

Potable & Non-potable Water :

Water which is of a standard suitable for drinking purposes is often referred to as being 'potable' other non-potable' water supplies for cleaning , washing and for use in the garden and ground.

11.4 Water Supplies In The Hotel :

In some remote areas, hotels may draw their supplies from wells bored in to aquifers. Where water spare, water from roofs and storm drains may be stored in tanks for use on the grounds.

Within the building, water supplies are designed to provide different types of water.

A variety of supplies are required for

- Cold water for drinking.
- Cold and hot water to bathrooms.
- Cold water to WCs and bidets.
- Hot water circulation for space heating.
- Water for fire fighting.
- Washing of hand, face gardening, vehicle Swimming, road, fountain.

Potable cold water supplies for drinking and cooking purposes will be taken straight from the mains, with no in immediate storage tank. For other purposes such as laundry use in the ground and swimming pool, cold water. Supplied be drawn from storage tank supply.

11.5 Water Quality

Can be defined in terms of chemical, bacteriological and organoleptic factors. The desired quality must be related to the actual use of the water supply. If for reasons of economy and to reduce the volume of chemicals used in water treat-ment –quality water supplies are to be used for purpose such as in WCs and for use in the grounds and gardens, then it is essential to ensure that there is no possibility of the contamination of potable water supplies with these lower-quality supplies, The two systems must be physically isolated and outlet points with non-potable supplies must be clearly labeled as not suitable for drinking.

A number of chemical contaminants of water lead 0.1 mg./lit use of lead pipe Aluminium, nitrates Leaching of agriculture land.Pesticide residues.

Hardness – Calcium & Magnesium salts $5\text{-}8^0$ degree 75 tolls ppm total 220 mg./lit. as $CaCo_3$.

Fluorides 0.5 to 1.5 ppm.

Chlorides 200 ppm.

Iron 0.1 mg/lit.

Total solids 500 mg/lit.

Bacteriological test B coil No. (in 100 ml)

Bacteria causes diseases.

Silt causes turbidity.

Algae causes color turbidity.

Animal detergents 0.2 mg/lit.

Mineral oil 0.01 mg/lit.

Cadmium 0.01 mg/lit-,Magnesium > 30 mg/lit, calcium 75 mg/lit.

Chromium 0.05 mg/lit, copper 0.05 mg/lit.

Zinc 5 mg/lit, cyanides 0.05 mg/lit.

Arsenic 0.05 mg/lit.

Selenium 0.01 mg/lit.

Magnese 0.05 mg/lit.

Polynudus automatic hydro about 2 mg/lit.

Phenolic compounds 0.001 mg/lit.

Mercury 0.001 mg/lit.

Color 10 – 20 Platinum cobalt scale testing to Tintometer.

Taste eodour Threshold number < 3

Smell 0 to 4 value.

Temperature 10 to 15.6^0 C

Turbidity 5 ppm. 2.5 JT scale, silica scale measured by Turbidity meter.

Dissolved oxyzen 5 to 10 ppm.

PH value 7 to 8.5 (Electromin calorimeter method)

Sulfates upto 250 ppm.

Carbonates alkalinity up to 110 ppm.

Rate demand of water –

Hotels

Guest	1 lit/bed,
Employees	2.5 to 3 lit/bed,
Restaurant meals	2 to 4 lit/seat.
Visitors	25% of number of guest purpose.
Drinking	2 lit/day/man.
Cooking	5 lit/day/head.
Bathing	30 to 40 lit/head/day,
Tub bath	50-80 lit/head/day.

11.6 Solar Hot Water System :

(a) Heat radiated by the sun is effectively trapped by solar collectors to heat water. A wide variety of solar heating system are now in use.

(b) Solar heating systems were initially used as a supplementary hot water source to a main hot water or stream boiler. But recent advances have made such system more efficient amd reliable, thus making them a primary source of hot water supplemented by other conventional sources.

(c) Building such a hotels, hospitals, hostels and manufacturing industries requiring hot water can usefully utilize solar hot water heating systems to save conventional fuels.

(d) To be effective and efficient the solar panels need to be oriented towards the south at an angle which depends on the latitude of the place. Solar panels require large surface areas on roof or at ground level with proper access for cleaning of the panels periodically and maintenance.

11.6.1 Solar Distillation- Solar Still:

The solar still consist of a shallow basin lined with a black impervious material which contains the saline water. A sloping transparent cover is provided at the top. Solar radiation is transmitted through the cover and is absorbed in the black lining. Thus it heat up the water by about 10o to 20o C and causes it to evaporate. The resulting vapour rises, condenses as pure water on the underside of the cover and flows into condensate collection channels on the sides.

11.7 Hot Water Distribution System :

A variety of hot-water piping layouts can be arranged. Some basic principles must however be followed for efficient, and economical design. Piping layouts have also to be decided on the basic of architectural and structural considerations.

(a) **Static pressure**, the pressure exerted at the bottom of a stationery head of water is related directly to its height.

(b) **Up feed system** needs pump to force the water every time as required.

(c) **Down feed system-**

A large tank is placed at the top of a building to supply water on demand Via gravity it needs pump for forcing where the tank is replenished Tall building utilizing a down feed system. Would experience high water pressure at the fix-tures.

11.8 Cold Water Supply Systems:

(A) DIRECT/NON STORAGE SYSTEM –

Advantages of direct system-

The direct or non-storage system (i) contains less pipework, (ii) has no cistern (or only a small one for the hot water system), (iii) easier and cheaper to install and maintain (iv) As all the water passes direct to the taps, all taps will have drinking water which has not been subjected to possible risk of contamination during storage.

Disadvantage of direct system-

(i) In the event of damage to mains supply, or during major maintenance, the premises may be completely without water.

(B) INDIRECT COLD WATER SUPPLY SYSTEM:

In this type of water system water is first stored in the overhead tank and then circulated to all the building. This requires more pipe work, a chance of contamination is there but it ensures proper supply with enough pressure.

11.9 Hot Water System

Hot water is needed for bathing and washing in domestic uses. Higher temperatures melt oil and grease from the human body, pots and pans, making the clean-up easy. Bathing with hot water opens the body pores, washing dirt and sweat easily and giving a sense of freshness.

In its rudimentary form, water in Indian homes is heated in pots on local stoves and heaters. However only a small quantity required for immediate use is heated. Fuel used varies from solid fuels, like wood and coal to kerosene, liquefied petroleum gas (LPG) and electricity. Except for every local use, this method of water heating is inefficient and dangerous. Open flames, apart from creating harmful gases, can also causes burn injuries which might lead to death.

Ambient air temperature in India varies widely form near Arctic conditions in Leh, (Jammu and Kashmir state) (-20o C or lower in winter) to 40-45oC in southern India. Hot water usage is, thus dictated by the weather conditions, bathing habits and economics. The requirement of hot water is calculated according to these conditions.

HOT WATER REQUIREMENT:

- Hot water is used in kitchens and bathrooms in residential areas.
- Hot Water may also be required as heating medium for space heating and air conditioning. The water is not consumed directly but the boiler capacity has to be increased to provide for the heat load.
- It is required for laundries and industrial kitchens and in buildings like hotels. Hospitals, hostels, schools, industrial canteens, etc.

Table : 11.1 Average Daily Hot water consumption.

		Lit/head per day
1.	**Factories:**	
(a)	Factories (with showers)	90
(b)	Factories (ablution only)	30-45
2.	**Hospitals :**	
(a)	Beds (patients, clean-up nurses stations,etc.)	180
(b)	Staff, doctors and nurses	90
(c)	Visitors	10
3.	**Hostels :**	
	(a) Colleges, schools, nurses' hostels, etc.	135
	(b) Officers, schools, colleges (day-use Where required)	145
4.	**Hotels :**	**Lit per head per day**
	(a) Room with shower	90
	(b) Room with tubs	135
	(c) Hotel staff	45
	(d) Visitors (Average 2 per room daily)	15
	(e) Swimming pool changing rooms	45
	(f) Kitchen/restaurant	5/meal served
5.	**Laundry :**	
	(a) Hotels 3-5 kg. linen/room	20 lit/kg linen
	(b) Hospitals 3-7 kg linen/bed	20 lit/kg linen
6.	**Sports stadium :** Showers	

Hot water generated in a central boiler must be supplied point of use efficiently without excessive loss of temperature and pressure.

the length of the pipe from the boiler to the point supply is long, the heat in the water will dissipate even when the pipes are insulated. On opening a tap hot water will come out of it only

after delivering the cold water in it taking a time of once to five minutes. If the rate of flow at the tap is about 8-10 lit/min, the user will waste about 8-50 lit. of water before getting the hot water. He would also have wasted the energy used for heating the water initially.

Recirculation –

To overcome this wastage of heat, a return pipe is installed from the remotest section of the hot water main which is connected back to the vessel supplying hot water to the building. In case there are a number of risers, each one is provided with a return line, connected to a common return heater to the boiler.

Thermo-siphonic action –

Circulation of hot water from the main pipe connected to the boiler and the return line can occur without the aid of a pump by thermosiphonic action which takes place due to the difference in the density of water at different tempreture.

REVERSE CIRCULATION SUSTEM :
Reverse circulation is similar to the upfeed system, except that the return flow occurs in the same direction as that of the main flow pipe (i) till the and of the remotest circuit from where it returns to the calorifier through a separate reverse return line (ii) This system is suitable where the circuits are long and where there is a likelihood of the least favorably placed fixtures not receiving adequate flow or pressure. A reverse return-line enables closer balancing of pressure in the system.

Many a time the main hot water flow and return lines are laid on the terrace of the building and supply pipes dropped to lower floors in pipe shafts.

11.10 Hot Water Generation

(a) Direct system –

(i) Ideal to small installations

(ii) Hot water from a boiler can be tapped directly for use.

(iii) 55-65^{o} C Temperature.

(iv) If the water has a pH lower than 7, its corrosive increases with rise in temperature and corrodes the boiler. This also makes the water to appeared.

(iv) When drawn off directly, the cold water entering the boiler near the bottom comes in contact with the boiler Furnace, which is at a high temperature. The contact generates a thermal imbalance, which may strain the body of the boiler and may develop cracks on the surface sheet of the fur-nance.

(vi) Boiler outlet nozzles must be large enough to match the rate of flow generated by the recirculating water in the distribution system.

(b) Indirect System :

(i) Hot water can also be generated indirectly by using the hot water or stream as a heating medium.

(ii) Hot water or steam generated in a boiler is circulated through a set of coils or tube bundle, in a primary circuit, which acts as the heat source.

Forced Hot water circulation –

(i) Generate pressure with in the system to force the circulation by means of a pump. This enables the reduction of pipe sizes and allows hot water to circulate in all parts of the system for quick off.

(ii) The circulation pump must be designed to overcome frictional losses within the circuit for a flow rate calculated for the heat losses.

(iii)The circulating pumps should never be used a booster pump for in-creasing the pressure in the hot water lines. The sources of pressure in the hot water system should be the same as that for the cold water supply so as to have nearly equal pressure at the point of supply.

Limitations Of Hot-Water Circulation :

When water is drawn off from a circulating sustem, the circulation temporarily ceases and open taps drawn water from the flow and return lines. Return pipes should therefore be designed to allow a partial draw off of hot water. This method not only reduces the pipe diameter of flow line but also utilizes the return line more efficiently. Circulation in this system occurs only in a steady state and in section of the system where no heavy drain off water is being made.

11.11 Hard water

Hard water is water that has high mineral content (in contrast with "soft water"). Hard water is formed when water percolates through deposits of calcium and magnesium-containing minerals such as limestone, chalk and dolomite.

Hard drinking water is generally not harmful to one's health, but can pose serious problems in industrial settings, where water hardness is monitored to avoid costly breakdowns in boilers, cooling towers, and other equipment that handles water. In domestic settings, hard water is often indicated by a lack of suds formation when soap is used in water, and by the formation of limescale in kettles and water heaters. Wherever water hardness is a concern, water softening is commonly used to reduce hard water's adverse effects.

11.11.1 Sources of hardness

Water's hardness is determined by the concentration of multivalent cations in the water. Multivalent cations are positively charged metal complexes with a charge greater than 1+. Usually, the cations have the charge of 2+. Common cations found in hard water include Ca^{2+} and Mg^{2+}. These ions enter a water supply by leaching from minerals within an aquifer. Common calcium-containing minerals are calcite and gypsum. A common magnesium mineral is dolomite (which also contains calcium). Rainwater and distilled water are soft, because they contain few ions.

The following equilibrium reaction describes the dissolving and formation of calcium carbonate :

$$CaCO_3\,(s) + CO_2\,(aq) + H_2O\,(l) \leftrightharpoons Ca^{2+}\,(aq) + 2HCO_3^-\,(aq)$$

The reaction can go in either direction. Rain containing dissolved carbon dioxide can react with calcium carbonate and carry calcium ions away with it. The calcium carbonate may be re-deposited as calcite as the carbon dioxide is lost to atmosphere, sometimes forming stalactites and stalagmites.

Calcium and magnesium ions can sometimes be removed by water softeners.

Temporary hardness

Temporary hardness is a type of water hardness caused by the presence of dissolved bicarbonate minerals (calcium bicarbonate and magnesium bicarbonate). When dissolved, these minerals yield calcium and magnesium cations (Ca^{2+}, Mg^{2+}) and carbonate and bicarbonate anions (CO_3^{2-}, HCO_3^-). The presence of the metal cations makes the water hard. However, unlike the permanent hardness caused by sulfate and chloride compounds, this "temporary" hardness can be reduced either by boiling the water, or by the addition of lime (calcium hydroxide) through the softening process of lime softening.[4] Boiling promotes the formation of carbonate from the bicarbonate and precipitates calcium carbonate out of solution, leaving water that is softer upon cooling.

Permanent hardness

Permanent hardness is hardness (mineral content) that cannot be removed by boiling. When this is the case, it is usually caused by the presence of calcium sulfate and/ormagnesium sulfates in the water, which do not precipitate out as the temperature increases. Ions causing permanent hardness of water can be removed using a water softener, or ion exchange column.

Total Permanent Hardness = Calcium Hardness + Magnesium Hardness

The calcium and magnesium hardness is the concentration of calcium and magnesium ions expressed as equivalent of calcium carbonate.

Total permanent water hardness expressed as equivalent of $CaCO_3$ can be calculated with the following formula: Total Permanent Hardness ($CaCO_3$) = $2.5(Ca^{2+}) + 4.1(Mg^{2+})$.

Effects of hard water

With hard water, soap solutions form a white precipitate (soap scum) instead of producing lather, because the 2+ ions destroy the surfactant properties of the soap by forming a solid precipitate (the soap scum). A major component of such scum is calcium stearate, which arises from sodium stearate, the main component of soap:

$$2\ C_{17}H_{35}COO^-\ (aq) + Ca^{2+}\ (aq) \rightarrow (C_{17}H_{35}COO)_2Ca\ (s)$$

Hardness can thus be defined as the soap-consuming capacity of a water sample, or the capacity of precipitation of soap as a characteristic property of water that prevents the lathering of soap. Synthetic detergents do not form such scums.

Hard water also forms deposits that clog plumbing. These deposits, called "scale", are composed mainly of calcium carbonate ($CaCO_3$),magnesium hydroxide ($Mg(OH)_2$), and calcium sulfate ($CaSO_4$). Calcium and magnesium carbonates tend to be deposited as off-white solids on the inside surfaces of pipes and heat exchangers. This precipitation (formation of an insoluble solid) is principally caused by thermal decomposition of bicarbonate ions but also happens in cases where the carbonate ion is at saturation concentration. The resulting build-up of scale restricts the flow of water in pipes. In boilers, the deposits impair the flow of heat into water, reducing the heating efficiency and allowing the metal boiler components to overheat. In a pressurized system, this overheating can lead to failure of the boiler. The damage caused by calcium carbonate deposits varies on the crystalline form, for example, calcite or aragonite.

In swimming pools, hard water is manifested by a turbid, or cloudy (milky), appearance to the water. Calcium and magnesium hydroxides are both soluble in water.

11.11.2 How to Remove Hardness from Water

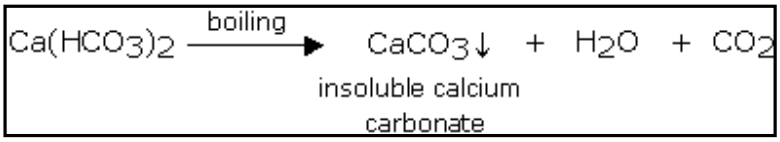
There are a number of methods to remove the hardness present in water. One those methods are being followed, the hard water gets converted to soft water. Some of the methods to remove hardness from water are,

- Chemical Process of Boiling Hard Water
- Adding Slaked Lime (Clark's Process)
- Adding Washing Soda
- Calgon Process
- Ion Exchange Process
- Using Ion Exchange Resins

Chemical Process of Boiling Hard Water

We can boil water to remove temporary hardness. Temporary hardness in water can be easily removed by boiling. On boiling, calcium/magnesium bicarbonate decomposes to give

calcium/magnesium carbonate, which is insoluble in water. Therefore, it precipitates out.

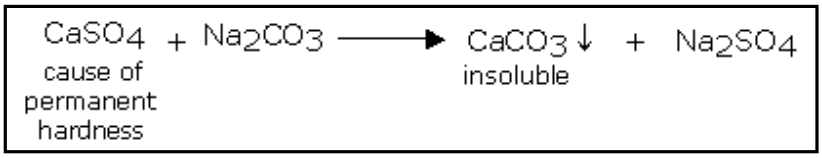


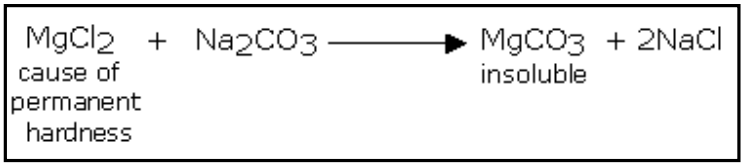
Adding Slaked Lime (Clark's Process)

In Clark's process, slaked lime, $Ca(OH)_2$ is added to temporary hard water. Insoluble calcium carbonate precipitate out and no longer produce hardness.

Adding Washing Soda

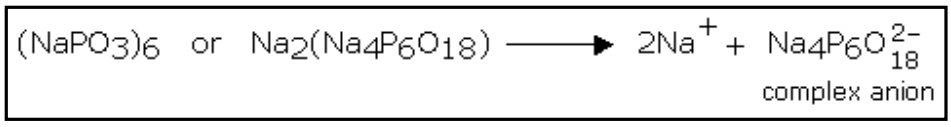
Calcium and magnesium ions present in hard water react with sodium carbonate to produce insoluble carbonates. The water now contains soluble and harmless sodium salts.



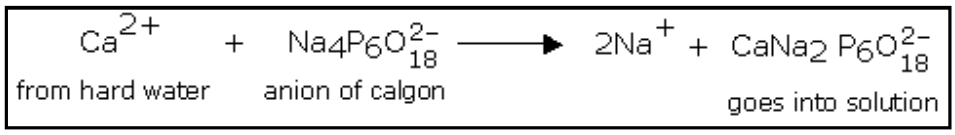


Calgon Process

Calgon is a trade name of a complex salt, sodium hexametaphosphate $(NaPO_3)_6$. It is used for softening hard water. Calgon ionizes to give a complex anion:



The addition of Calgon to hard water causes the calcium and magnesium ions of hard water to displace sodium ions from the anion of Calgon.

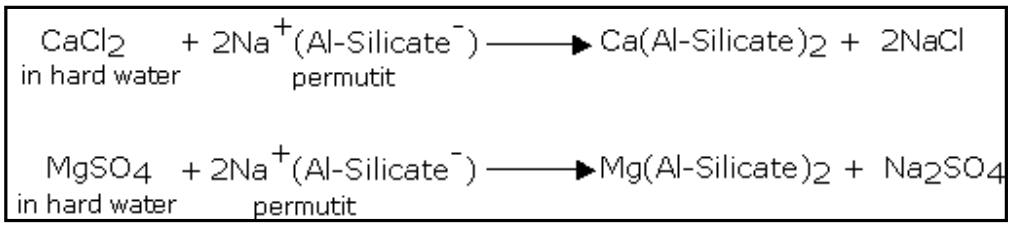


This results in the removal of calcium and magnesium ions from hard water in the form of a complex with Calgon. The water is softened and sodium ions are released into water.

Ion Exchange Process (Permutit Process)

Permutit or sodium aluminium silicate is a complex chemical compound, which occurs as a natural mineral called Zeolite. Permutit or zeolites are insoluble in water and have the property of exchanging ions present in them with the ions present in the solution.

Permutit or zeolites are packed in a suitable container and a slow stream of hard water is passed through this material. As a result, calcium and magnesium ions present in hard water are exchanged with sodium ions in the permutit (Na^+Al-Silicate). The outgoing water contains sodium salts, which do not cause hardness.



This is the basic concept of ion exchange and hardness removal.

Using Ion Exchange Resins

Giant organic molecules having acidic or basic groups are known as Ion-exchange resins. Acid resins contain the acid group (- COOH).

Acid resins exchange their H^+ ions with other cations such as Ca^{2+}, Mg^{2+}, etc., present in hard water. Acid resins are, therefore known as base-exchange resins.

$2RCOO^-H^+ + Ca^{2+} \longrightarrow (RCOO)_2Ca + 2H^+$

base exchange resin or acid resir — from hard water

$RCOO^-H^+ + Na^+ \longrightarrow RCOONa + H^+$

acid resin — from water

Basic resins exchange their OH^- ions with the other anions such as HCO_3^-, Cl^-, SO_4^{2-}, present in hard water. Basic resins, therefore, are also known as acid exchange resins.

$RNH_3^+OH^- + Cl^- \longrightarrow RNH_3Cl + H^+$

basic resin or acid exchange resin — from water

$2RNH_3^+OH^- + SO_4^{2-} \longrightarrow (RNH_3)_2SO_4 + 2OH^-$

basic resin — from water

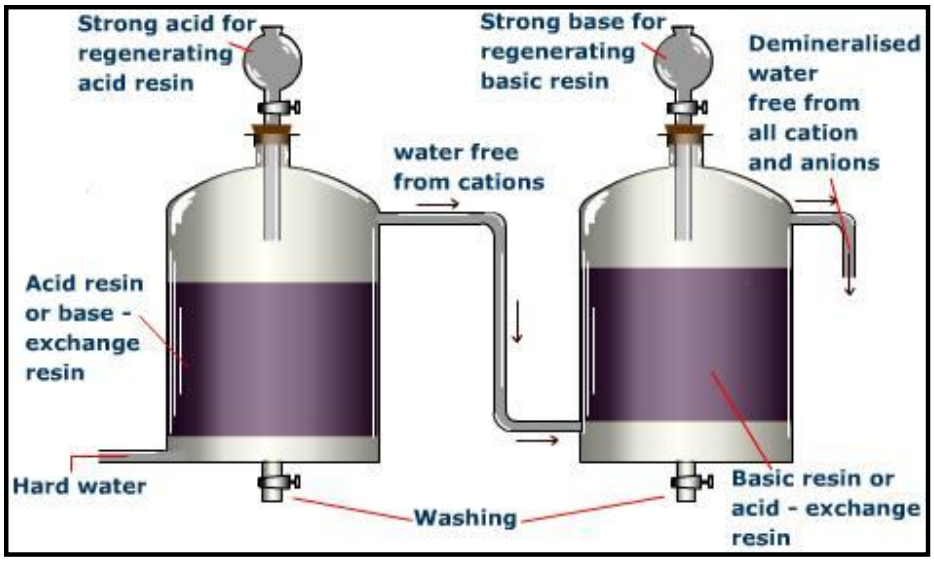


Fig: 11.1 - Ion-exchange process for water softening

In the ion exchange process, hard water is passed through two tanks

'A' and 'B'. Tank- A contains acid resin and tank- B is filled with basic resin. All the cations present in hard water (except H^+) are removed by the acid resin present in Tank- A, and the basic resin present in Tank- B removes all the anions (except OH^-) present in hard water. Water obtained after passage through both the tanks is free from all the cations and anions that make it hard. The water obtained after passing through the ion-exchangers is called deionised water or demineralised water. This is as good as distilled water. The water becomes soft after this process.

11.12 Summary

The most important use of water in agriculture is for irrigation, which is a key component to produce enough food. Irrigation takes up to 90% of water withdrawn in some developing countries and significant proportions in more economically developed countries (United States, 30% of freshwater usage is for irrigation).

Fifty years ago, the common perception was that water was an infinite resource. At this time, there were fewer than half the current number of people on the planet. People were not as wealthy as today, consumed fewer calories and ate less meat, so less water was needed to produce their food. They required a third of the volume of water we presently take from rivers. Today, the competition for the fixed amount of water resources is much more intense, giving rise to the concept of peak water.This is because there are now nearly seven billion people on the planet, their consumption of water-thirsty meat and vegetables is rising, and there is increasing competition for water from industry, urbanisation and biofuel crops. In future, even more water will be needed to produce food because the Earth's population is forecast to rise to 9 billion by 2050.

11.13 Review Questions

Q1 Write a short note on the importance of water.

Q2 What are the various uses of water?

Q3 What are the various sources of water supply? Briefly discuss Tube well.

Q4 What is hardness of water? Discuss about permanent Hardness.

Q 5 What are the various methods of removal of hardness?

Q6 Elaborate the ion exchange method of removal of hardness.

11.14 References and Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan.
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UNIT 12

ELECTRICITY

Structure

12.0 Learning Objectives

The learner will be able to understand the various concepts of electricity along with the basic understanding of electric flow etc. The learner will also be able identify different types of fuses, their structure and importance of fuses in electrical settings. In the unit leaner will also be able to identify various types of bulbs their maintenance and repair and impact on the electrical loads.

12.1 Introduction

An agent which cause the property of attraction in the substances & the substances possessing this property are called as electrified or charged with electricity.

Or A natural force which can not be seen, heard or handle like other object. Type of electricity are.

(a) Electrostatic electricity.
(b) Electrodynamic electricity :

The quantity of electricity which passes through a conductor in a given time.

ENERGY FLOWS –

Primary Energy - Processes that create new energy.

Derived energy - Processes that change primary energy into another form of energy.

Secondary energy Sources –

A secondary energy is one where the energy has undergone conversion from one form to another. The most common secondary energy source is electricity where thermal energy, from fossil fuels, and kinetic energy, in moving water, are converted into electrical energy. The process of converting fossil fuels into elec- tricity has a low efficiency, but the use of combined heat and power (CHP) can increase this to 80 -90 per cent.

The functioning of most of the electrical appliances depend on, the electricity. If the electrical energy service is interrupted for a short period, large percentage of the services offered by hotels eg. Food service units, clubs, health care units etc. will cease and cannot be activated to the normal level until the flow of electrical energy is resumed to an adequate quantity. The hotel industry is dependent on electricity for heat, light and power. Hence the dependence on such type of the source of energy cannot be under estimated and value in the hotel life is almost impossible to accurately determine. Because electrical energy not only provide heat, light and power but it also provides means of communication, control system etc. thus electricity is used in hotel industry in the following cases –

(i) For operating lifts, elevators & escalators *(ii)* Space lighting *(iii)* Ventilation *(iv)* Refrigeration *(v)* Air conditioning *(vi)* Stereo system *(vii)* TV *(viii)* Heating *(ix)* Water pumping *(x)* Food preparation and many other functions.

12.2 Nature Of Electric Current :

All matters are made up of minute particles called molecules. Which can be further subdivided into atoms.

Elements are composed of molecules containing atoms of one kind only. Mendeleyev's periodic system gives classification of elements. The number of elements are 101 eg. Hydrogen, Carbon, Nitrogen, Oxyen, Sodium, Magne – sium, etc.

Compounds are composed of molecules containing atoms of different kinds. The number of compounds is almost infinite.

Atoms of all substances are built up of positive electricity called protons & negative electricity called electrons.

Neutrons which show no electrical state.

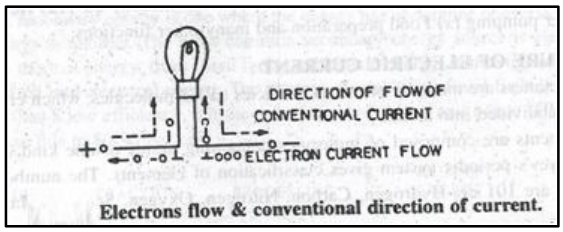
An atom consists of a central nucleus made up of protons and neutrons and around this nucleus there are number of electrons revolving in different orbits. In the normal state the number of protons equals to the number of electrons and the atom as a whole is electrically neutral. Atomic number means, number of pro- tons. eg. Hydrogen 1, Helium 2, Lithium 3, Beryllium 4, Boron 5, Carbon 6, Nitrogen 7, Oxygen 8, Fluorine 9, Neon 10, Sodium 11, Magnesium 12, Aluminium 13, Silicon 14, Phosphorous 15, Sulphur 16, Chlorine 17, Argon 18, Potassium 19, Calcium 20, Scandium 21, Titanium 22,Vanadium 23, Chromium 24, Manganese 25, Iron 26, Cobalt 27, Nicket 28, Copper 29, atomic, weight is the sum of protons & neutrons. Eg. hydrogen 1, Helium 4, Lithium 7, Beryllium 9, Boron 11, Carbon 12, Nitrogen 14, Oxygen 16, Fluorine 19, Neon 20, Sodium 23, Magnesium 25, Aluminium 27, Silicon 28, phosphorous 31, Sulphur 32, Chlorine 35, Argon 40, Potassium 39, Calcium 40, Scandium 45, Titanium 48, Vanadium 51, Chromium 52, Manganese 55, Iron 56, Cobalt 59, Copper 64, etc.

The revolving electrons are held to the nucleus by an attractive force. In conductors they are easily displaced. The electrons in outer most orbit are called free electrons, they can move from an atom to another.

When difference of potential is applied between the ends of a conductor the haphazard movement of charges: causes a steady flow along the conductor and it is this moving stream of electrons which constitutes an electric current.

The electron movement however is impeded by collision with the molecules giving rise to a certain opposition to the flow of currents called resistance.

The flow of current is from positive to negative. Electrons flows from negative to positive.



Electrons flow & conventional direction of current.

In insulators the electrons are firmly held and hence if a potential difference is applied little or no electrons flow occurs.

12.3 Concept Of Different Electrical Quantities :

(A) TYPES OF CHARGES –

There are Two types of charges –

(i) **Positive charge –** When an atom looses one electron it becomes a positive charge.

(ii) **Negative charge –** Electron has a negative charge.

(B) VOLTAGE –

The electric Voltage at any point is known as the potential of that point. The Voltage is measured in volts.Volt is the unit of electromotive force – a measure of the electrical pressure force of an electric level.Electromotive force is the force which starts & maintains of electronic current through a conductor.

The difference of the electrical voltage between the two points in a circuit is known of the potential difference. Electrical potential difference is work done in moving a unit of charge.

(C) CHARGE –

The quantity of electricity residing on an electrostatically charged body.The unit of charge is coulomb.

I coulomb = 6.29×10^{18} electrons

I electron charge = 1.602×10^{19} coloumb.

(D) CURRENT –

The rate flow of electric charge is current. The flow of electron in a con- doctor is current. The unit of current is ampere.

(E) AMPERE –

Flow of I coulomb of charge in one second is ampere.

1Amp= 1Coloumb/1 sec.

12.4 Electrical Safety Methods :

The electrical appliances liable to be dangerous if they are not properly used. The life of the appliances can be increased by using safety methods. For the person using these appliances following two types of safety devices are used.

(i) Fuses (ii) Earthing

FUSE – Is a small link of a soft metal connected in electrical circuit which serves a safety valve, shortpiece of wire found between terminals.

It melts as soon as an excessive current passes through any circuit where the circuit is overload or any short circuit occurs or leakages takes place.

Fuse Wire :

Material – Low melting temperature

- Copper, Silver, Antimony, Tin, Lead, Zinc, Alluminum.

Lead Tinned copper > 15 A

Lead & tinalloy 15 A

Reliable in rating

Suitable capacity.

Rated Current of fuses –

Current for indefinite period without undue heating melting depends –

(i) Fuse's holder (ii) Temperature of fuse content.
Rated current < Mi nimum fuse current

Fusing or melting current = 1/2 Value of melting current

Rated current – Heat produced = Heat radiated

Causes of blown fuse –

- Too many appliances plugged into a circuit;
- Plugging a power appliance into a lighting circuit:

Short circuit due to insulation failure, i.e. lead and return wires tough and therefore currentdoes not reach other applicance ; often due to wear of wire insulation (see Fig. 12.71).

REPAIR OF FUSES :

1. Turn off the main switch.
2. Find the fuse that has blown – this may be known before hand; if not, try each one in turn.
3. Remove broken fuse wire.
4. Replace with appropriate cartridge fuse ; or
5. Replace with new fuse wire of the correct size (5,10,15 or 30 amperes).
6. Before replacing the repaired fuse and before switching on, endeavour to trace the fault and repair it.

Safety in renewal of fuse – No exposed teriminals fixing screw or metal are in fuse hand, Cartridge type fuse element must have holders of safety types.

A/V
16/240 HRC type

32/415 HRC type
63/415 HRC type
100/415 HRC type
200/415 HRC type

S.NO.	*For the Protection of*		*Means of Protection*
1.	General circuit		Link Fuse.
2.	Other circuit and apparatus.	(i)	Standard Plug type fuses.
		(ii)	Standard cartridge fuses.
		(iii)	Time – lag fuses.
		(iv)	H.R.C. fuses.

The equipment current exceeds, the wire gets heated to such a temperature that it melts and blows up. Thus the circuit breakup and the equipment is quite safe.

THE QUALITIES OF FUSE ARE –

(a) Isolation or separation of fuse from the terminals
(b) The box case which holds the fuse wire should be of insulating materials,water proof and spark should not come out when the fuse wire melts.
(c) It should be easy to replace the fuse.

The fuse units available are –

(a) Round type fuse unit (b) Kit Kat/rewirable
(b) Cartridge type fuse unit (d) HRC type fuse unit

(A) ROUND TYPE FUSE UNIT –

It is made of porcelain or Bakelite having two separated wire terminals for holding the fuse wire between them.

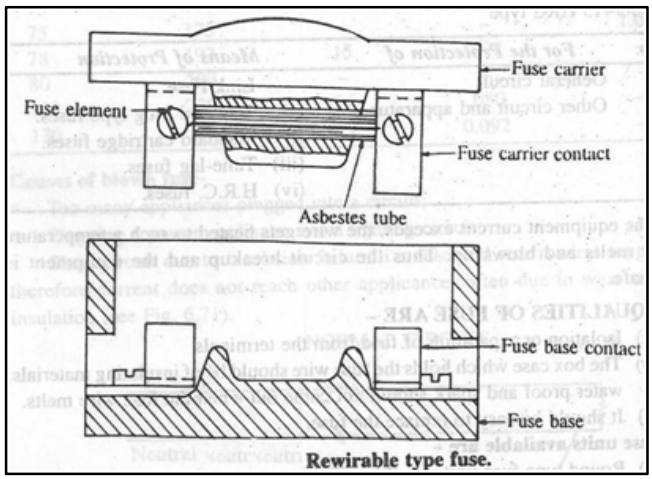
Following are the disadvantages –

(i) One of the terminal is always energized with live (Positive or phase) wire of the supply.
(ii) For the replacement of fuse wire it is very dangerous to insert th fuse wire between the two terminals unless, the main switch is to be opened or some precautions to be observed.

(B) REWIRABLE TYPE OR KIT KAT FUSE UNIT –

It is the most important and common type of fuse unit used for all day- to day work in domestic installations. It can be rewired, even if the cut- out terminals are energized, without taking any safety precautions. The part fuse carrier which holds the fuse wire is a separate unit

and can be taken out or inserted with care in the base to which the incoming and outgoing live wire is permanently connected.



Rewirable type fuse.

The metallic part of the fuse carrier when inserted in the base touches melatic terminal of the base, thus keeping continuity from one base terminal to the second base terminal through the wire. Fig. above shows such type of fuse.

The cut- outs are made of china – clay and are rated for 15 amp to 300 amp current values.

These are very simple in operation. Rewiring of fuse wire can be handled safely even if the main supply is on. Usually these fuses are kept in cast iron boxes. But now-a-days are kept in molded plastic boxes.

(C) CARTRIDGE TYPE FUSE UNIT -

By Cartridge we mean any shape similar to the bullet containing some enclosed material. In cartridge type fuse the fuse wire is enclosed in a tube, bulb or case of some good insulating heat resistance material of the whole unit is sealed off.

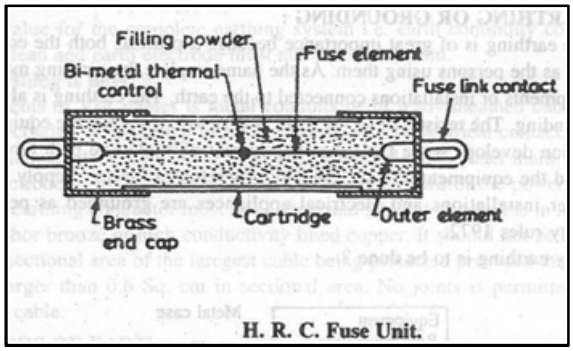
In case the fuse blows out due to some fault or overload it is replaced by a fresh unit as the cartridge cannot be rewired due to its sealing.

There is an index circle like a peep hole, which in normal condition is clear or transparent, but becomes blackened in case the fuse blows out thereby showing the broken circuit. Some types of cartridges are of rewirable type also. These are fixed in its fuse carrier like the kit-kat unit. These are used for 60 to 600 A.

(D) H.R.C. TYPE FUSE UNIT -

By H.R.C. Fuse we mean high rupturing capacity fuse. It is similar in con- struction to the cartridge type with the exception that the fuse wire (material) can carry heavy current for a

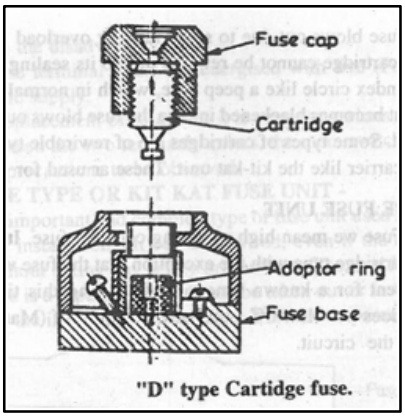
known time period. During this time if the fault is removed then it does not blow off, otherwise it blows off (Material) and breaks the continuity of the circuit.



H. R. C. Fuse Unit.

The cartridge (enclosure of the H.R.C.) unit is either of glass or some other chemical compound that is air tight construction to avoid the effect of atmosphere on the fuse material. This effect may lower its rated capacity due to continuous slow oxidation of the wire materials. H.R.C. cartridge fuse, in its simple form, consists of a ceramic body having metal end caps to which are welded fusible silver (or bimetallic) current carrying elements. The space within the body surrounding the elements is completely packed with a filling powder. This type of fuse is reliable and has inverse time characteristics.

High voltage H.R.C. cartridge type of fuses are used up to 33 KV. Liquid type fuses have the widest range of application in H.V. Systems. They may be used for voltage transformer, protection or for circuits up to about 400 amp. Rated current, on systems up to 132 KV or higher. The liquid which surrounds the fuse elements helps to extinguish the arc when the fuse blows.



"D" type Cartidge fuse.

12.5 Earthing or Grounding

The earthing is of great importance because it protects both the equipment as wells as the persons using them. As the name implies the earthing means that the equipments or installations connected to the earth. The earthing is also called the grounding. The resistance of the earth is

very low. So when the equipment or installation develops some fault then the current will take the path through the earth and the equipment will remain safe. Therefore all power supply systems, consumer installations and electrical appliances are grounded as per Indian electricity rules 1972.

Why earthing is to be done ?

Let us consider an electrical equipment which is enclosed in a metal casing and the instrument is not earthed and let us assume that it is kept on a wooden table.

Suppose now that the insulation of the line conductor inside goes bad and the conductor comes in contact with the metal casing etc. If the appliance is itself kept on a wooden table, the casing would then be at the same potential as the conductor i.e. it would now become live.

If now by chance some person touches the body of the equipment and that person is not properly insulated then the current will flow through his body and he may experience a shock, which may be fatal.

Now if the body of the equipment is properly earthed then there will be large amount of the current flowing through the line because of very low resistance of the earth and the fuse in series with the equipment will blow and the equipment will be isolated from the line. However at this time any person incidentally touches the equipment, the current will not pass through his body because the resistance of the body is very much larger in comparison to the earth resistance. For earthing every equipment 3 pin plug is used. The third pin which is relatively larger in the diameter is used for earthing purpose.

Its value for the complete earthing system i.e. earth continuity conductor, earthing lead and earth electrode must not exceed one ohm.

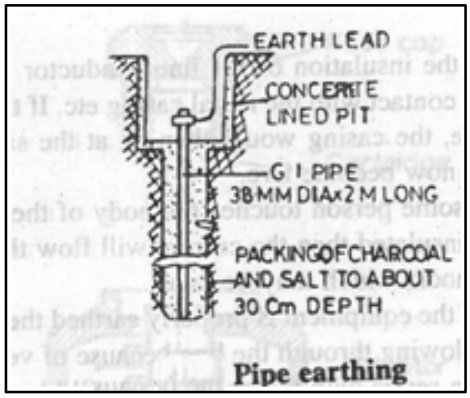
How earthing is done ?

Systems of VIR cables is metal conduits or of lead- sheathed cables must have the conduit or sheathing in good mechanical and electrical contact, bonded and maintained at earth potential by being connected to the water main, separate earth electrode or the earth terminal on the terminal board of the power supply.

The earthing conductor must be as short and straight as possible in its run be of phosphor bronze or high conductivity lined copper. It should not be less than half the sectional area of the laregest cable being protected provided that it need not be larger than 0.6 Sq. cm in sectional area. No joints is permitted in the earthing cable.

METHODS OF EARTHING :

(A) EARTHING TO WATER MAIN – First the cold water pipe is thoroughly cleared of all grease and dirt. An adjustable clip is fixed at the cleaned spot. One end of the earthing cable is fixed to a lug which is attached to the clip by a fixing bolt and nut, tightening the nut draws the clip tight to grip the pipe firmly. The other end of the earthing cable is similarly connected to the conduit with a clamp and lug.



Pipe earthing

(B) PIPE EARTHING – A galvanized iron pipe 38 mm in diameter and 2 meter long is driven into the ground or a copper plate of adequate size buried edge wise in the earth is used as the earth electrode. Its resistance must be kept below specified limit, packing salts and powdered code or charcoal to a depth of 30 cm, all around the pipe in low resistance, keeping the earth moist by pouring water in to the pipe.

According to the Indian Elecricity Rules, the frame of all motors, transformers etc and the metal casings of all power consuming equipments shall be earthed by two separate and distinct connection with earth.

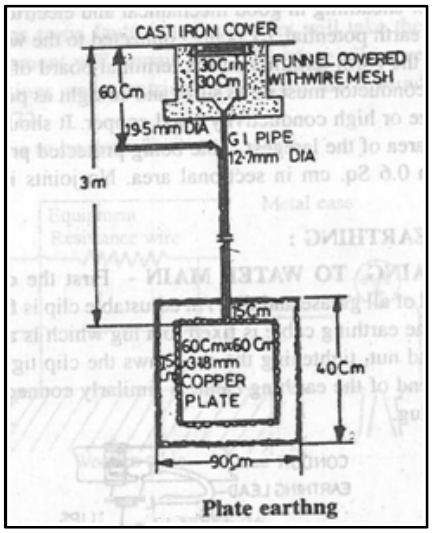


Plate earthng

On electrical appliance the manufacturer provides an earthing terminale. The foundation bolts used for hold down the machines are often used for eathing them.

(C) PLATE EARTHING – The earth connection can be provided with the help of a copper/G.I. plate is used it should not be of less than 60 cm x 60 cm x 6.35 mm.

The plate is kept with its face vertical at a depth of 3 m and is so arranged that it is embedded in an alternate layer of coke and salt for a minimum thickness of about 15 cm in case earthing is done by copper plate and in coke layer of 15 cm. if it is done with G.I. plate. The earth wire is securely bolted to the earth plate with the help of bolt.nut and washer.

Name of Machine	*No. of Earth.*
Single phase 1/4 HP motor	**1.**
3 Phase 5 HP motor to 100 HP motor	2.
Conduit pipe	1.
Wall bracket	1.
Fan regulator	1.
Portable heater /	1.
1000/440 V. Transformer	2.
Medium Voltage	2.

Specifications of Earthing as per B.I.S. (Indian Bureue of Indian standard institution) for providing good earthing are :

(i) The earthing electrode should be situated at a place at least 1 ½ metre away from (i.e. outside) the building whose installation system is being earthed.

(ii) The earth wire should be of same material as that of earth electrode.

(iii) The minimum sectional area of the earth lead wire should never be less than 0.02 sq. inch (No. 8 S.W.G.) and not more than 0.1 sq. inch (i.e.7.036 S.W.G.).

(iv) The size of earth conductor as a general rule should not be less than half of the section of live line conductor.

(v) The size of the continous earth wires used with cables should not be either less than 0.0045 sq. in (14 S.W.G.) or half of the installation conductor size in case of light wiring.

THE EFFECT OF ELECTRIC SHOCK MAY BE DEATH :

(i) Due to fibrillation of heat i.e. damaging the hearty to small pieces causing the stopping of breathing

(ii) Due to stopping of breathing action caused by blockage in the nervous system causing respiration.

(iii) Due to local over heating or burning of the body.

The seriousness of the electric shock depends on –

- The current strength
- The frequency of the current

- The path taken by the current through the body.

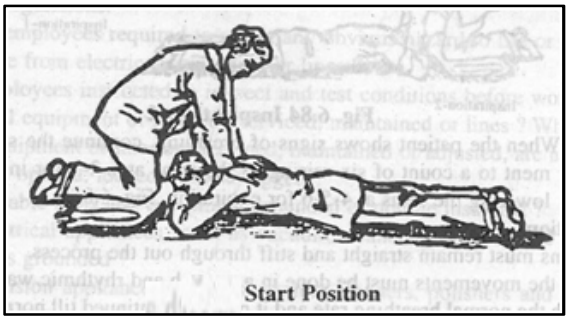
Precautions against shock –

- Try to avoid work on live mains.
- If you have to work on live mains be sure that be sure that before working see that your hands or feet are not wet.
- Try to keep your left hand in the pocket
- Do not work in such a place where your head is liable to touch the live mains.

In the case of shock –

If due to the shock the victims become unconsicious. Stops breathing and his heart still beats. The most urgent & immediate cure is that he should be given immediately artificial respiration.

(i) Place the patient flat on the ground with face downward the head resting on the two hands placed one on the other.


Start Position

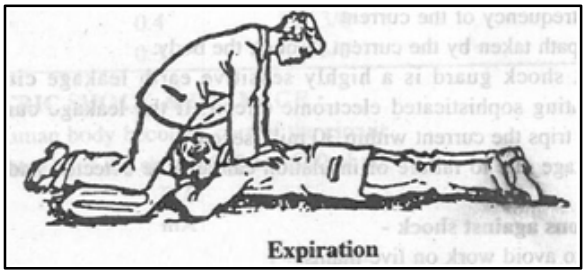
(ii) Take up a position at the head of the patient in line with his body.

(iii) Kneel on one knee & place the other foot near the patients shoulder.

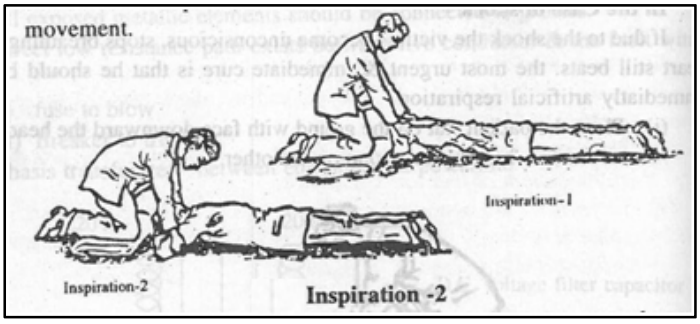
(iv) Place both your hands. On the patient's back with palms on the shoulder blades, the thumbs in line with spine and the fingers pointing down the back.

(v) Keeping your arms straight lean forward slowly till the arms become vertical. By then a light pressure is applied on the patient's back and cause expiration. (Fig. above) do this operation to count 1-2-3.

(vi) Come back to the first position and pause for one second (fig below) inspiration - 1


Expiration

(vii) Slide your hands over the patient's shoulder & hold his arms just above the elbows.
(viii) Raise and pull on the arms, this will induce inspiration or breathing in of air.
(ix) Do this operation to a count of 1-2-3 followed by a pause of one second.
(x) Next lower the patient's arms to their original position to repeat the movement.



(xi) When the patient shows signs of breathing, continue the second movement to a count of six raising of the arms at -1-2-3 for inspiration and lowering the arms at 4-5-6 for expiration.

Precautions –

- Arms must remain straight and stiff throughout the process.
- All the movements must be done in a smooth and rhythmic way to coincide with the normal breathing rate and it must be continued till normal breathing is restored.
- While the artificial respiration is being applied a doctor is needed.

12.6 Electrical Safety Precautions

An accident may be defined as an unplanned and unexpected event which causes or is likely to cause an injury.

Precautions –

(i) Always use correct size of fuse
(ii) Always maintain earth connection in satisfactory condition.
(iii) Before replacing a lamp or handling a table fan be sure that the switch is in off position.
(iv) Before switching on current, be make sure that probable equipment is properly earthed and insulation is sound.
(v) Before working on inductive circuits or cables, discharge them.
(vi) Never touch an overhead line.
(vii) Never energise a line unless you are sure that there is no one working on that line.
(viii) Never bring a naked light near a battery, smoking is prohibited in the battery room.
(ix) Rubber mats must be placed in front of electric panels and switch boards.

In case of fire

(i) Disconnect the supply.
(ii) Do not throw water on equipment
(iii) Do not use a fire extinguisher on electricity.

Illumination required for various purposes

1. Corroders	0.1 to 5 ft. candle
2. Staircase	20 ft. candle
3. Storage	0.1 to 5 ft. candle
4. Toilets	0.1 to 5 ft. candle
5. Bath room mirror	30 ft. candle, General 10ft. candle
6. Exhibition	30 ft candle
7. Dancing halls	0.1 to 5 ft. candle
8. Night clubs	0.1 to 5 ft. candle
9. Bars	0.1 to 5 ft. candle
10. Restaurant	10 ft. candle
11. Lunch room	10 ft. candle
12. Dining halls	10 ft. candle
13. Conference room	10 ft. candle
14. Reception room	10 ft. candle
15. Waiting room	10 ft. candle
16. Lobby and lounge	10 ft. candle
17. Outside light	15 ft. candle
18. For writing	30 ft. candle
19. Kitchen	50 to 100 foot. candle
20. Drawing room	30 ft. candle
21. Entrance active	50 ft. candle
22. Makeup	50 ft. candle
23. Entrance Inactive	10 ft. candle
24. Vital location	70 ft. candle
25. Cashier	50 ft. candle
26. Service counter	70 ft. candle
27. Elevators /lifts	20 ft. candle
28. Laundry washing	30 ft. candle
29. Press work	50 ft. candle
30. Finishing	70 ft. candle
31. Safe parking	20 ft. candle
32. Attendant parking	10 ft. candle

33. Maintenance department 30 ft. candle

Lighting Schemes: These are –

(i) Direct lighting - Maximum light is thrown towards the ceiling from where it is diverted to the room through diffuse reflection. This lighting is suitable for drawing offices, word shops.

Illumination will be depressive to the eye.

(ii) Semi direct lighting 50% of the light is sent from the source directly on the reading plane and 30% is send upward.

Different globes are used

Scheme provides uniform distributed light

(iii) Semi indirect lighting 40% light is send upward and 40% is sent directly on the surface.

Semi translucent plastic bowls are used.

12.7 Lighting Lamps

There are six different families of lamps : incandescent & quartz. Fluorescent, mercury vapour, metal- halide, high – pressure sodium, and low pressure sodium. Table 12.11 includes selected characteristics of various lamp types that should be considered prior to selection.

S No.	Lamp	Colour Rendering	Initial Efficiency	Lumen Maintenance	Lamp life	Cost	
						Initial	Operating
I.	Incandescent and Quartz	High	Low	High	Short	Low	High
II.	Fluorescent cool white warm white	Moderate	High	Moderate	Moderate	Moderate	Low
III.	Fluorescent	High	Moderate	Moderate	Moderate	High	Moderate
IV.	High- pressure Sodium	Low	High	High	Long	Low	Low

(I) INCANDESCENT & QUARTZ LAMPS – Are inefficient in production of light relative to other lamp types have a short life, and are very sensitive to voltage changes. On the positive side such lamps are inexpensive start in stantly, and provide a warm colour that is flattering to the skin.

A special category of incandescent lamps is the tungsten halogen or quartz lamp. The quartz lamp maintains a constant light level throughout its life and has a life about three to four times

longer than the standard incandescent. It is also more expensive than the standard incandescent. Efficiency of light output is only slightly ahead of the standard incandescent.

ELECTRIC DISCHARGE LAMP –

It has transparent enclosure and contain a gas or vapour at pressure. At the two ends of the lamp electrodes are provided for connecting the lamp to the main. Light is obtained from the excited atom of the gas.

The Halogen Bulb

This runs on electricity and comprises five individually controlled heat zones, each of which has four tungsten halogen lamps located under a smooth ceramic glass surface. The heat source glows red, when switched on, getting brighter as the temperature increases.

When it is switched on, 70 per cent of the heat is transmitted as infrared light directly into the base of the cooking pan, the rest is from conducted heat via the ceramic glass. Ordinary pots and pans may be used on the halogen hob.

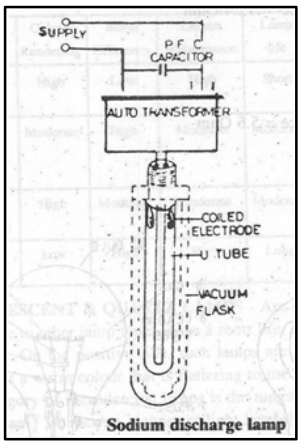
The halogen range includes a convection oven, and the halogen hob unit is also mounted on a stand.

Sodium Discharge Lamp –

It is in the form of U – glass tube is enclosed in a double walled flask. In addition to sodium a small quantity of INERT gas (argon) is also inserted.

The colour is bright yellow and is recommended only for street lighting.

Low Pressure Mercury Discharge Lamp –



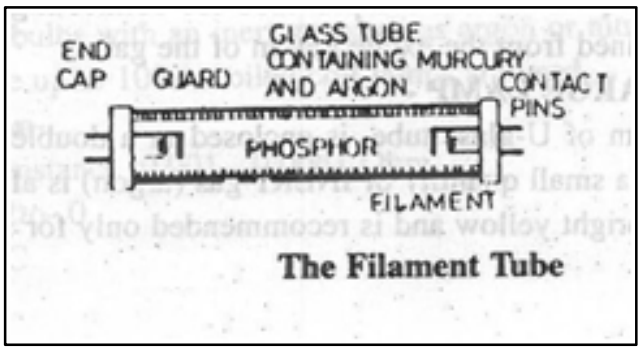
Sodium discharge lamp

(II) Fluorescent lamps – Have greater efficiency in the production of light than incandescent lamps. Less than 10 percent of the wattage of an incandescent lamp goes to

produce light, but between 16 and 20 percent of the input energy becomes visible light with a fluorescent lamp. This lamp type also has a long life; on an average, a fluorescent lamp lasts 30,000 hours. Such lamps are inexpensive and readily available. The lamps are available in cool white (CW) and warm white (WW) for general use, plus other special application lamps.

Problems with fluorescents include difficulties in starting and decreasing output at low temperatures, which limits outdoor use.

MERCURY FLUORESCENT LAMPS OR TUBES – Due to low pressure the lamp is in the form of long tube, coating of inside the tube is done with phosphor. For commercial use the phosphor usually contain a heavy impurity called activator.



The Filament Tube

The starter filaments of the tube and the choke all form one series circuit. The series choke acts as a ballast when the lamp is running and it also provides a voltage impuse for starting.

Fluorescent bulbs in globe luminaries can be installed at the edges of exhaust hoods at regular intervals in kitchen.

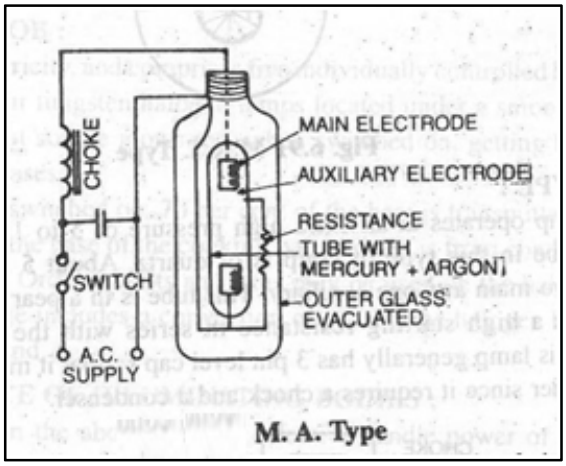
NEON LAMP –

It is used for illuminating sign boards, it emits orange pink coloured light.

It consists of two electrodes which are made of pure iron. The electrodes are spaced few mm apart in spiral coiled lamp. The tubes can be made in any shape different gases are filled in the tubes to get different colours such as argon for red colour, neon with mixture of mercury for green colour and Helium for yellow colour. It works on high voltage in the range of 2000 to 6000 volts.

HIGH PRESSURE MERCURY VAPOUR LAMPS –

(I) M.A. TYPE :



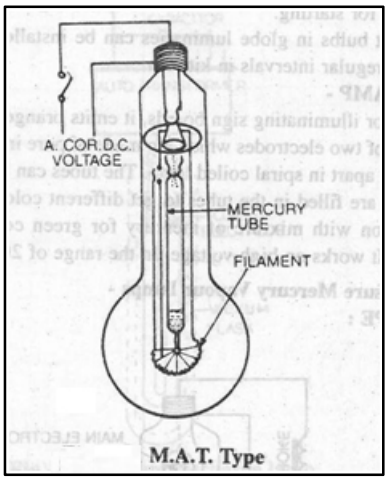
It consists of a glass tube of borosilicate which is quite hard. At the two ends in the tube are provided two electrodes of specially coated wire. Near the upper electrode is an other auxiliary starting electrode which is connected to the bottom electrode through a high resistance. The tube is sealed with an inside pressure of 1 ½ atmosphere. The tube is further enveloped by another tube. The lamp has a screwed cap and is connected to the main supply through a choke. A condenser is connected across the main.

The inner tube in addition to mercury also contains a small quantity of argon gas.

(II) MAT TYPE :

The outer tube consists of tungsten filament in series with the discharge tube so that it acts as a blast. It can be used for ac as well as dc mains.

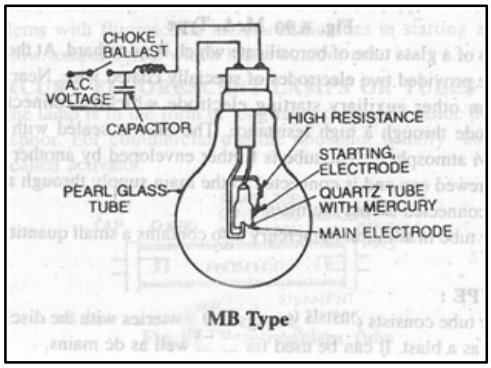
The colour given out by the MAT type lamp is of poor appearance since it is short of red colour while light given by this lamp consists of a mixture of lights due to discharge lamp. The colour so obtained is more soothing.



(III) MB TYPE :

This lamp operates at an extra high pressure of 5 to 10 atmosphere. The discharge tube in this type of lamp is of quartz. About 5 cm long has three electrodes two main and one auxiliary. This tube is in a pearl glass bulb.

There is a high starting resistance in series in series with the auxiliary starting electrode. This lamp generally has pin level cap so that it may not be put in an ordinary holder since it requires a chock and a condenser.



MB Type

ARC LAMP :

The arc is produced by bringing two carbon electrodes together momentarily and then separating them. This process can be carried by hand or by automatic mechanism. A ballast is required in series because of the negative volt ampere characteristics of the arc. A resistance ballast for DC arc where as an inductance is used with AC arc.

The source of light is the incandescent electrode.

Such lamps are used in search lights.

12.8 Maintenance of lamps, bulb and others

Lighting systems are designed to provide a desired level of illumination adequate for the activity that must take place in an area. Maximum illumination begins to decrease almost immediately, however, and maintenance must address dirt on the lamps, decreasing lamp output and dirt on the walls and ceilings all of which reduce reflectance.

Neglected lamps out a gas reduce illumination. Moreover, if burned out lamps are not promptly replaced illumination may drop to unsafe levels in a short time. Lamp replacement is done either by an individual or group method. Individual methods involve replacing burned out lamps on request group replacement involves installing new lamps in all fixtures in the prescribed areas after they have been in use 70 to 75 percent of their rated life.

12.9 Summary

The functioning of most of the electrical appliances depend on, the electricity. If the electrical energy service is interrupted for a short period, large percentage of the services offered by hotels eg. Food service units, clubs, health care units etc. will cease and cannot be activated to the normal level until the flow of electrical energy is resumed to an adequate quantity. The hotel industry is dependent on electricity for heat, light and power. Hence the dependence on such type of the source of energy cannot be under estimated and value in the hotel life is almost impossible to accurately determine

12.10 Review Questions

Q 1. Define electricity, Volt and ohms.

Q 2 Write a short note on Fuse, also discuss various types of fuses used in electrical circuits.

Q 3 Incandescent & Quartz Lamps

Q4 Electrical Safety Precautions

Q 5 How earthing is done ?

Q 6 What are the various Methods Of Earthing ?

12.11 Suggested Reading

1. Hotel Housekeeping, Sudhir Andrews, Tata McGraw Hill
2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan

UNIT 13

LIGHTING AND LIGHTING NEEDS

Structure

13.0 Objectives

- Students know about types of lighting which is used in catering industry;
- They know about different lighting devices.
- They can do comparative study of different light.

13.1 Introduction

Lighting or **illumination** is the deliberate use of light to achieve a practical or aesthetic effect. Lighting includes the use of both artificial light sources like lamps and light fixtures, as well as natural illumination by capturing daylight. Day lighting (using windows, skylights, or light shelves) is sometimes used as the main source of light during daytime in buildings. This can save energy in place of using artificial lighting, which represents a major component of energy consumption in buildings. Proper lighting can enhance task performance, improve the appearance of an area, or have positive psychological effects on occupants.

Indoor lighting is usually accomplished using light fixtures, and is a key part of interior design. Lighting can also be an intrinsic component of landscape projects.

Types of lighting,

A demonstration of the effects of different kinds of lighting Lighting is classified by intended use as general, accent, or task lighting, depending largely on the distribution of the light produced by the fixture.

- Task lighting is mainly functional and is usually the most concentrated, for purposes such as reading or inspection of materials. For example, reading poor-quality reproductions may require task lighting levels up to 1500 lux (150 foot-candles), and some inspection tasks or surgical procedures require even higher levels.
- Accent lighting is mainly decorative, intended to highlight pictures, plants, or other elements of interior design or landscaping.
- General lighting (sometimes referred to as ambient light) fills in between the two and is intended for general illumination of an area. Indoors, this would be a basic lamp on a table or floor, or a fixture on the ceiling. Outdoors, general lighting for a parking lot may be as low as 10-20 lux (1-2 footcandles) since pedestrians and motorists already used to the dark will need little light for crossing the area.

Methods

- Down lighting is most common, with fixtures on or recessed in the ceiling casting light downward. This tends to be the most used method, used in both offices and homes. Although it is easy to design it has dramatic problems with glare and excess energy consumption due to large number of fittings. The introduction of LED lighting has greatly improved this by

approx. 90% when compared to a halogen downlight or spotlight. LED lamps or bulbs are now available to retro fit in place of high energy consumption lamps.

- Up lighting is less common, often used to bounce indirect light off the ceiling and back down. It is commonly used in lighting applications that require minimal glare and uniform general luminance levels. Up lighting (indirect) uses a diffuse surface to reflect light in a space and can minimize disabling glare on computer displays and other dark glossy surfaces. It gives a more uniform presentation of the light output in operation. However indirect lighting is completely reliant upon the reflectance value of the surface. While indirect lighting can create a diffused and shadow free light effect it can be regarded as an uneconomical lighting principle.

- Front lighting is also quite common, but tends to make the subject look flat as its casts almost no visible shadows. Lighting from the side is the less common, as it tends to produce glare near eye level. Backlighting either around or through an object is mainly for accent.

Forms of lighting

Forms of lighting include alcove lighting, which like most other uplighting is indirect. This is often done with fluorescent lighting (first available at the 1939 World's Fair) or rope light, occasionally with neon lighting, and recently with LED strip lighting. It is a form of backlighting.

Soffit or close to wall lighting can be general or a decorative wall-wash, sometimes used to bring out texture (like stucco or plaster) on a wall, though this may also show its defects as well. The effect depends heavily on the exact type of lighting source used.

Recessed lighting (often called "pot lights" in Canada, "can lights" or 'high hats" in the US) is popular, with fixtures mounted into the ceiling structure so as to appear flush with it. These downlights can use narrow beam spotlights, or wider-angle floodlights, both of which are bulbs having their own reflectors. There are also downlights with internal reflectors designed to accept common 'A' lamps (light bulbs) which are generally less costly than reflector lamps. Downlights can be incandescent, fluorescent, HID (high intensity discharge) or LED.

Track lighting, invented by Lightolier, was popular at one period of time because it was much easier to install than recessed lighting, and individual fixtures are decorative and can be easily aimed at a wall. It has regained some popularity recently in low-voltage tracks, which often look nothing like their predecessors because they do not have the safety issues that line-voltage systems have, and are therefore less bulky and more ornamental in themselves. A master transformer feeds all of the fixtures on the track or rod with 12 or 24 volts, instead of each light fixture having its own line-to-low voltage transformer. There are traditional spots and

floods, as well as other small hanging fixtures. A modified version of this is cable lighting, where lights are hung from or clipped to bare metal cables under tension.

A sconce is a wall-mounted fixture, particularly one that shines up and sometimes down as well. A touchier is an uplight intended for ambient lighting. It is typically a floor lamp but may be wall-mounted like a sconce.

The portable or table lamp is probably the most common fixture, found in many homes and offices. The standard lamp and shade that sits on a table is general lighting, while the desk lamp is considered task lighting. Magnifier lamps are also task lighting.

The illuminated ceiling was once popular in the 1960s and 1970s but fell out of favor after the 1980s. This uses diffuser panels hung like a suspended ceiling below fluorescent lights, and is considered general lighting. Other forms include neon, which is not usually intended to illuminate anything else, but to actually be an artwork in itself. This would probably fall under accent lighting, though in a dark nightclub it could be considered general lighting.

In a movie theater, steps in the aisles are usually marked with a row of small lights for convenience and safety, when the film has started and the other lights are off. Traditionally made up of small low wattage, low voltage lamps in a track or translucent tube, these are rapidly being replaced with LED based versions.

Outdoor lighting

Street Lights are used to light roadways and walkways at night. Some manufacturers are designing LED and photovoltaic luminaires to provide an energy-efficient alternative to traditional street light fixtures.

Floodlights can be used to illuminate outdoor playing fields or work zones during nighttime hours. The most common type of floodlights are metal halide and high pressure sodium lights.

Beacon lights are positioned at the intersection of two roads to aid in navigation.

Sometimes security lighting can be used along roadways in urban areas, or behind homes or commercial facilities. These are extremely bright lights used to deter crime. Security lights may include floodlights.

Entry lights can be used outside to illuminate and signal the entrance to a property. These lights are installed for safety, security, and for decoration.

Underwater accent lighting is also used for koi ponds, fountains, swimming pools and the like.

13.2 Types of Lighting

Three are three basic types of lighting that work together in your home:

1. **Ambient (general lighting)**

2. **Task**
3. **Accent**

A good lighting plan combines all three types to light an area according to function and style.

Ambient: Also called general lighting, ambient lighting provides overall illumination for a room, and is intended to create a uniform light level throughout a space, independent of any special lighting that may be needed in targeted areas of a room. In most home settings, when a person steps into a room and flips on a switch, ambient lighting illuminates the space. Ambient lighting takes many forms, including: ceiling-mounted or recessed fixtures that direct light downwards; wall sconces or floor-lamp torchieres that wash the walls with light; cove, soffit and valance lighting that bounces light off ceilings and walls.

Task Lighting

Task: Targeted to a particular area of a room, task lighting is intended to illuminate a specific function. Areas of a home that require task lighting include kitchen counters where food will be prepared; living room seating areas where reading will take place; and home office desk surfaces where paperwork will be done. In a kitchen, under-cabinet lighting provides task lighting for a countertop; in a living room, a table lamp is often used for task lighting to accommodate reading.

Accent Lighting

Accent: Also called highlighting, accent lighting draws attention to a particular object, such as artwork, sculpture, plants or bookcases. Accent lighting is often used outdoors, to highlight a beautiful tree, plant or water feature, or to draw the eye to a particular area of the landscape. Recessed or track lighting is often used for accent lighting, with adjustable fittings that allow light to be focused precisely even on a small object.

When planning the layers of light in a room, it usually makes sense to consider the ambient lighting first, then consider task and accent lighting. "I like to move from general to specific

when planning the lighting for a room," says lighting designer Markus Earley of Providence, R.I. With rooms that are heavily task-oriented, however, such as home offices, some designers focus on task lighting first. And in a hallway that doubles as a photo or art gallery, accent lighting might be the first consideration.

"It's so important to think about how you really use a space, and what you do in specific rooms," says interior designer Bruce Fox, partner at Wells & Fox, which has offices in Chicago and Boston. "Only then you can start to identify where you need task lighting and accent lighting."

13.3 Different lighting devices

Incandescence

When solids and liquids are heated, they emit visible radiation at temperatures above 1,000 K; this is known as incandescence.

Such heating is the basis of light generation in filament lamps: an electrical current passes through a thin tungsten wire, whose temperature rises to around 2,500 to 3,200 K, depending upon the type of lamp and its application.

There is a limit to this method, which is described by Planck's Law for the performance of a black body radiator, according to which the spectral distribution of energy radiated increases with temperature. At about 3,600 K and above, there is a marked gain in emission of visible radiation, and the wavelength of maximum power shifts into the visible band. This temperature is close to the melting point of tungsten, which is used for the filament, so the practical temperature limit is around 2,700 K, above which filament evaporation becomes excessive. One result of these spectral shifts is that a large part of the radiation emitted is not given off as light but as heat in the infrared region. Filament lamps can thus be effective heating devices and are used in lamps designed for print drying, food preparation and animal rearing.

Electric discharge

Electrical discharge is a technique used in modern light sources for commerce and industry because of the more efficient production of light. Some lamp types combine the electrical discharge with photoluminescence.

An electric current passed through a gas will excite the atoms and molecules to emit radiation of a spectrum which is characteristic of the elements present. Two metals are commonly used, sodium and mercury, because their characteristics give useful radiations within the visible spectrum. Neither metal emits a continuous spectrum, nor discharge lamps have selective spectra. Their colour rendering will never be identical to continuous spectra. Discharge lamps are often classed as high pressure or low pressure, although these terms are only relative, and a high-pressure sodium lamp operates at below one atmosphere.

Types of Luminescence

Photoluminescence occurs when radiation is absorbed by a solid and is then re-emitted at a different wavelength. When the re-emitted radiation is within the visible spectrum the process is called *fluorescence* or *phosphorescence*.

Electroluminescence occurs when light is generated by an electric current passed through certain solids, such as phosphor materials. It is used for self-illuminated signs and instrument panels but has not proved to be a practical light source for the lighting of buildings or exteriors.

Evolution of Electric Lamps

Although technological progress has enabled different lamps to be produced, the main factors influencing their development have been external market forces. For example, the production of filament lamps in use at the start of this century was possible only after the availability of good vacuum pumps and the drawing of tungsten wire. However, it was the large-scale generation and distribution of electricity to meet the demand for electric lighting that determined market growth. Electric lighting offered many advantages over gas- or oil-generated light, such as steady light that requires infrequent maintenance as well as the increased safety of having no exposed flame, and no local by-products of combustion.

During the period of recovery after the Second World War, the emphasis was on productivity. The fluorescent tubular lamp became the dominant light source because it made possible the shadow-free and comparatively heat-free lighting of factories and offices, allowing maximum use of the space. The light output and wattage requirements for a typical 1,500 mm fluorescent tubular lamp is given in table 1.

Table 1. Improved light output and wattage requirements of some typical 1,500 mm fluorescent tube lamps

Rating (W)	Diameter (mm)	Gas fill	Light output (lumens)
80	38	argon	4,800
65	38	argon	4,900
58	25	krypton	5,100
50	25	argon	5,100 (high frequency gear)

By the 1970s oil prices rose and energy costs became a significant part of operating costs. Fluorescent lamps that produce the same amount of light with less electrical consumption were demanded by the market. Lamp design was refined in several ways. As the century closes there is a growing awareness of global environment issues. Better use of declining raw materials, recycling or safe disposal of products and the continuing concern over energy consumption (particularly energy generated from fossil fuels) are impacting on current lamp designs.

Performance Criteria

Performance criteria vary by application. In general, there is no particular hierarchy of importance of these criteria.

Light output*:* The lumen output of a lamp will determine its suitability in relation to the scale of the installation and the quantity of illumination required.

Colour appearance and colour rendering: Separate scales and numerical values apply to colour appearance and colour rendering. It is important to remember that the figures provide guidance only, and some are only approximations. Whenever possible, assessments of suitability should be made with actual lamps and with the colours or materials that apply to the situation.

Lamp life*:* Most lamps will require replacement several times during the life of the lighting installation, and designers should minimize the inconvenience to the occupants of odd failures and maintenance. Lamps are used in a wide variety of applications. The anticipated average life is often a compromise between cost and performance. For example, the lamp for a slide projector will have a life of a few hundred hours because the maximum light output is important to the quality of the image. By contrast, some roadway lighting lamps may be changed every two years, and this represents some 8,000 burning hours.

Further, lamp life is affected by operating conditions, and thus there is no simple figure that will apply in all conditions. Also, the effective lamp life may be determined by different failure modes. Physical failure such as filament or lamp rupture may be preceded by reduction in light output or changes in colour appearance. Lamp life is affected by external environmental

conditions such as temperature, vibration, frequency of starting, supply voltage fluctuations, orientation and so on.

It should be noted that the average life quoted for a lamp type is the time for 50% failures from a batch of test lamps. This definition of life is not likely to be applicable to many commercial or industrial installations; thus practical lamp life is usually less than published values, which should be used for comparison only.

Efficiency*:* As a general rule the efficiency of a given type of lamp improves as the power rating increases, because most lamps have some fixed loss. However, different types of lamps have marked variation in efficiency. Lamps of the highest efficiency should be used, provided that the criteria of size, colour and lifetime are also met. Energy savings should not be at the expense of the visual comfort or the performance ability of the occupants. Some typical efficacies are given in table 2.

Table 2. Typical lamp efficacies

Lamp efficacies	
100 W filament lamp	14 lumens/watt
58 W fluorescent tube	89 lumens/watt
400 W high-pressure sodium	125 lumens/watt
131 W low-pressure sodium	198 lumens/watt

Main lamp types

Over the years, several nomenclature systems have been developed by national and international standards and registers.

In 1993, the International Electrotechnical Commission (IEC) published a new International Lamp Coding System (ILCOS) intended to replace existing national and regional coding systems. A list of some ILCOS short form codes for various lamps is given in table 3.

Table 3. International Lamp Coding System (ILCOS) short form coding system for some lamp types

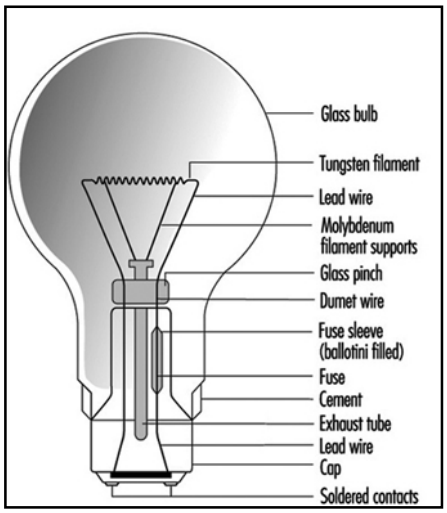
Type (code)	**Common ratings (watts)**	**Colour rendering**	**Colour temperature (K)**	**Life (hours)**
Compact fluorescent lamps (FS)	5–55	good	2,700–5,000	5,000–10,000

High-pressure mercury lamps (QE)	80–750	fair	3,300–3,800	20,000
High-pressure sodium lamps (S-)	50–1,000	poor to good	2,000–2,500	6,000–24,000
Incandescent lamps (I)	5–500	good	2,700	1,000–3,000
Induction lamps (XF)	23–85	good	3,000–4,000	10,000–60,000
Low-pressure sodium lamps (LS)	26–180	monochromatic yellow colour	1,800	16,000
Low-voltage tungsten halogen lamps (HS)	12–100	good	3,000	2,000–5,000
Metal halide lamps (M-)	35–2,000	good to excellent	3,000–5,000	6,000–20,000
Tubular fluorescent lamps (FD)	4–100	fair to good	2,700–6,500	10,000–15,000
Tungsten halogen lamps (HS)	100–2,000	good	3,000	2,000–4,000

Incandescent lamps

These lamps use a tungsten filament in an inert gas or vacuum with a glass envelope. The inert gas suppresses tungsten evaporation and lessens the envelope blackening. There is a large variety of lamp shapes, which are largely decorative in appearance. The construction of a typical General Lighting Service (GLS) lamp is given in figure 1.

Figure 1. Construction of a GLS lamp



Incandescent lamps are also available with a wide range of colors and finishes. The ILCOS codes and some typical shapes include those shown in table below.

Common colors and shapes of incandescent lamps, with their ILCOS codes

Colour/Shape	**Code**
Clear	/C
Frosted	/F
White	/W
Red	/R
Blue	/B
Green	/G
Yellow	/Y
Pear shaped (GLS)	IA
Candle	IB
Conical	IC
Globular	IG
Mushroom	IM

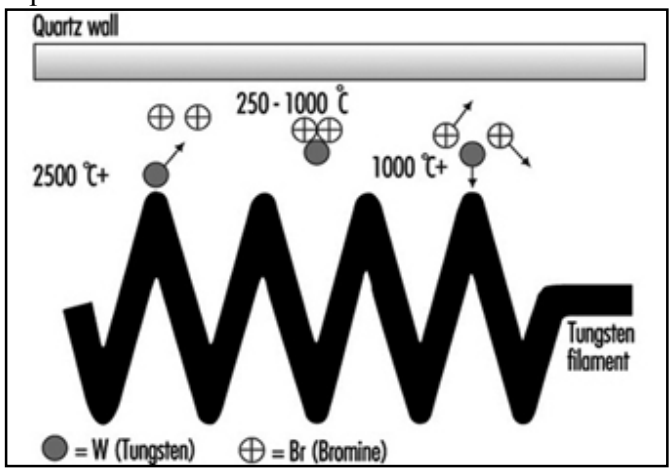
Incandescent lamps are still popular for domestic lighting because of their low cost and compact size. However, for commercial and industrial lighting the low efficacy generates very high operating costs, so discharge lamps are the normal choice. A 100 W lamp has a typical efficacy of 14 lumens/watt compared with 96 lumens/watt for a 36 W fluorescent lamp.

Incandescent lamps are simple to dim by reducing the supply voltage, and are still used where dimming is a desired control feature.

The tungsten filament is a compact light source, easily focused by reflectors or lenses. Incandescent lamps are useful for display lighting where directional control is needed.

Tungsten halogen lamps

These are similar to incandescent lamps and produce light in the same manner from a tungsten filament. However the bulb contains halogen gas (bromine or iodine) which is active in controlling tungsten evaporation.



Fundamental to the halogen cycle is a minimum bulb wall temperature of 250 °C to ensure that the tungsten halide remains in a gaseous state and does not condense on the bulb wall. This temperature means bulbs made from quartz in place of glass. With quartz it is possible to reduce the bulb size.

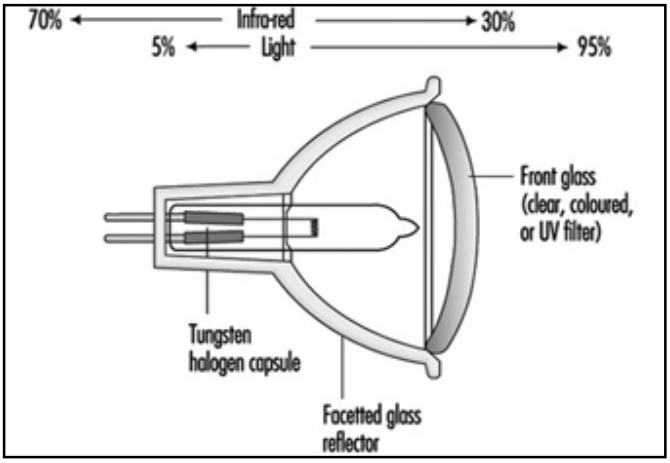
Most tungsten halogen lamps have an improved life over incandescent equivalents and the filament is at a higher temperature, creating more light and whiter colour.Tungsten halogen lamps have become popular where small size and high performance are the main requirement. Typical examples are stage lighting, including film and TV, where directional control and dimming are common requirements.

Low-voltage tungsten halogen lamps

These were originally designed for slide and film projectors. At 12 V the filament for the same wattage as 230 V becomes smaller and thicker. This can be more efficiently focused, and the larger filament mass allows a higher operating temperature, increasing light output. The thick filament is more robust. These benefits were realized as being useful for the commercial display

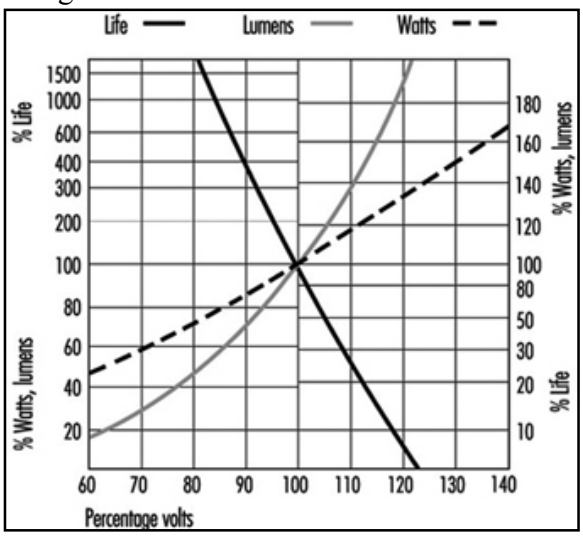
market, and even though it is necessary to have a step-down transformer, these lamps now dominate shop-window lighting. See figure 3.

Figure 3. Low-voltage dichroic reflector lamp



Although users of film projectors want as much light as possible, too much heat damages the transparency medium. A special type of reflector has been developed, which reflects only the visible radiation, allowing infrared radiation (heat) to pass through the back of lamp. This feature is now part of many low-voltage reflector lamps for display lighting as well as projector equipment.

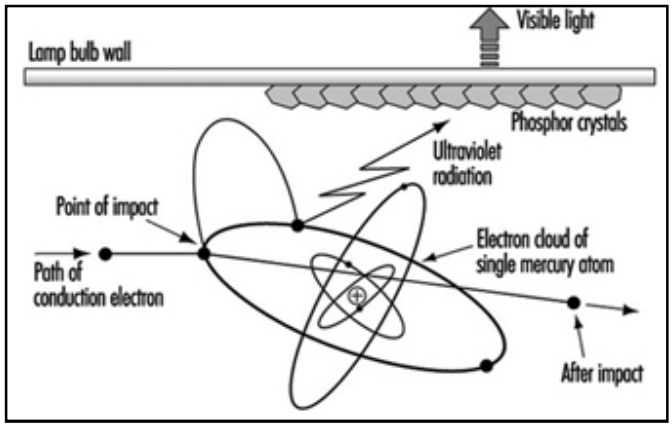
Voltage sensitivity: All filament lamps are sensitive to voltage variation, and light output and life are affected. The move to "harmonize" the supply voltage throughout Europe at 230 V is being achieved by widening the tolerances to which the generating authorities can operate. The move is towards ±10%, which is a voltage range of 207 to 253 V. Incandescent and tungsten halogen lamps cannot be operated sensibly over this range, so it will be necessary to match actual supply voltage to lamp ratings. See figure 4



Discharge lamps will also be affected by this wide voltage variation, so the correct specification of control gear becomes important

Tubular fluorescent lamps

These are low pressure mercury lamps and are available as “hot cathode” and “cold cathode” versions. The former is the conventional fluorescent tube for offices and factories; “hot cathode” relates to the starting of the lamp by pre-heating the electrodes to create sufficient ionization of the gas and mercury vapour to establish the discharge.Cold cathode lamps are mainly used for signage and advertising



Fluorescent lamps require external control gear for starting and to control the lamp current. In addition to the small amount of mercury vapour, there is a starting gas (argon or krypton).The low pressure of mercury generates a discharge of pale blue light. The major part of the radiation is in the UV region at 254 nm, a characteristic radiation frequency for mercury. Inside of the tube wall is a thin phosphor coating, which absorbs the UV and radiates the energy as visible light. The colour quality of the light is determined by the phosphor coating. A range of phosphors are available of varying colour appearance and colour rendering.

During the 1950s phosphors available offered a choice of reasonable efficacy (60 lumens/watt) with light deficient in reds and blues, or improved colour rendering from “deluxe” phosphors of lower efficiency (40 lumens/watt).By the 1970s new, narrow-band phosphors had been developed. These separately radiated red, blue and green light but, combined, produced white light. Adjusting the proportions gave a range of different colour appearances, all with similar excellent colour rendering. These tri-phosphors are more efficient than the earlier types and represent the best economic lighting solution, even though the lamps are more expensive. Improved efficacy reduces operating and installation costs.

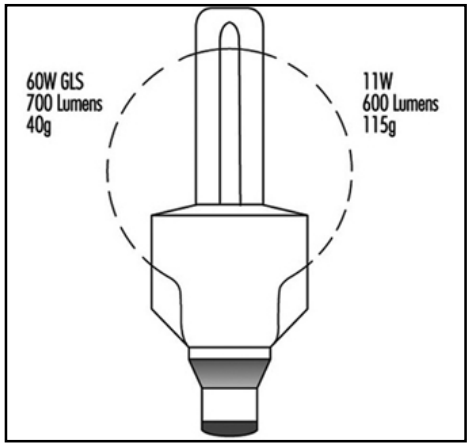
The tri-phosphor principle has been extended by multi-phosphor lamps where critical colour rendering is necessary, such as for art galleries and industrial colour matching.

The modern narrow-band phosphors are more durable, have better lumen maintenance, and increase lamp life.

Compact fluorescent lamps

The fluorescent tube is not a practical replacement for the incandescent lamp because of its linear shape. Small, narrow-bore tubes can be configured to approximately the same size as the incandescent lamp, but this imposes a much higher electrical loading on the phosphor material. The use of tri-phosphors is essential to achieve acceptable lamp life. See figure 6.

Figure 6. Four-leg compact fluorescent



All compact fluorescent lamps use tri-phosphors, so, when they are used together with linear fluorescent lamps, the latter should also be tri-phosphor to ensure colour consistency.

Some compact lamps include the operating control gear to form retro-fit devices for incandescent lamps. The range is increasing and enables easy upgrading of existing installations to more energy-efficient lighting. These integral units are not suitable for dimming where that was part of the original controls.

***High-frequency electronic control gear*:** If the normal supply frequency of 50 or 60 Hz is increased to 30 kHz, there is a 10% gain in efficacy of fluorescent tubes. Electronic circuits can operate individual lamps at such frequencies. The electronic circuit is designed to provide the same light output as wire-wound control gear, from reduced lamp power. This offers compatibility of lumen package with the advantage that reduced lamp loading will increase lamp life significantly. Electronic control gear is capable of operating over a range of supply voltages. There is no common standard for electronic control gear, and lamp performance may differ from the published information issued by the lamp makers.

The use of high-frequency electronic gear removes the normal problem of flicker, to which some occupants may be sensitive.

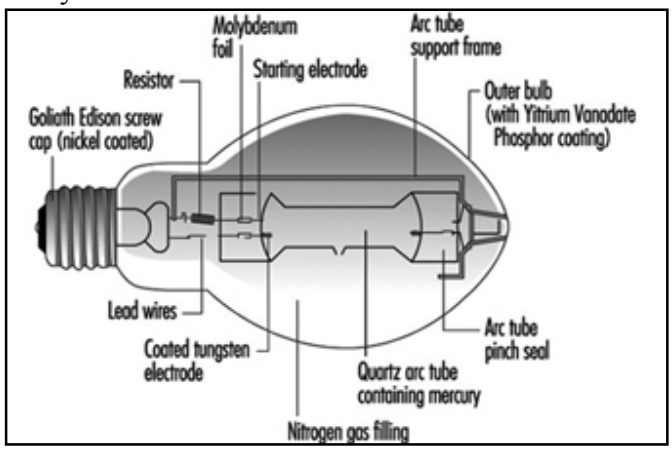
Induction lamps

Lamps using the principle of induction have recently appeared on the market. They are low-pressure mercury lamps with tri-phosphor coating and as light producers are similar to fluorescent lamps. The energy is transferred to the lamp by high-frequency radiation, at approximately 2.5 MHz from an antenna positioned centrally within the lamp. There is no

physical connection between the lamp bulb and the coil. Without electrodes or other wire connections the construction of the discharge vessel is simpler and more durable. Lamp life is mainly determined by the reliability of the electronic components and the lumen maintenance of the phosphor coating.

High-pressure mercury lamps

High-pressure discharges are more compact and have higher electrical loads; therefore, they require quartz arc tubes to withstand the pressure and temperature. The arc tube is contained in an outer glass envelope with a nitrogen or argon-nitrogen atmosphere to reduce oxidation and arcing. The bulb effectively filters the UV radiation from the arc tube.



At high pressure, the mercury discharge is mainly blue and green radiation. To improve the colour a phosphor coating of the outer bulb adds red light. There are deluxe versions with an increased red content, which give higher light output and improved colour rendering.All high-pressure discharge lamps take time to reach full output. The initial discharge is via the conducting gas fill, and the metal evaporates as the lamp temperature increases. At the stable pressure the lamp will not immediately restart without special control gear. There is a delay while the lamp cools sufficiently and the pressure reduces, so that the normal supply voltage or ignite or circuit is adequate to re-establish the arc.

Discharge lamps have a negative resistance characteristic, and so the external control gear is necessary to control the current. There are losses due to these control gear components so the user should consider total watts when considering operating costs and electrical installation. There is an exception for high-pressure mercury lamps, and one type contains a tungsten filament which both acts as the current limiting device and adds warm colours to the blue/green discharge. This enables the direct replacement of incandescent lamps.Although mercury lamps have a long life of about 20,000 hours, the light output will fall to about 55% of the initial output at the end of this period, and therefore the economic life can be shorter.

Metal halide lamps

The colour and light output of mercury discharge lamps can be improved by adding different metals to the mercury arc. For each lamp the dose is small, and for accurate application it is more

convenient to handle the metals in powder form as halides. This breaks down as the lamp warms up and releases the metal.A metal halide lamp can use a number of different metals, each of which give off a specific characteristic colour. These include:

- dysprosium—broad blue-green
- indium—narrow blue
- lithium—narrow red
- scandium—broad blue-green
- sodium—narrow yellow
- thallium—narrow green
- tin—broad orange-red

There is no standard mixture of metals, so metal halide lamps from different manufacturers may not be compatible in appearance or operating performance. For lamps with the lower wattage ratings, 35 to 150 W, there is closer physical and electrical compatibility with a common standard.Metal halide lamps require control gear, but the lack of compatibility means that it is necessary to match each combination of lamp and gear to ensure correct starting and running conditions.

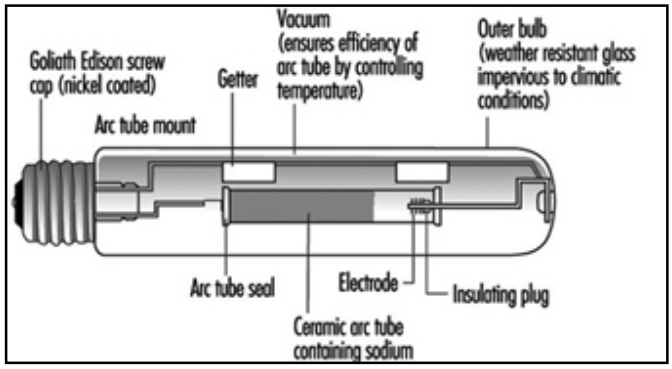
Low-pressure sodium lamps

The arc tube is similar in size to the fluorescent tube but is made of special ply glass with an inner sodium resistant coating. The arc tube is formed in a narrow "U" shape and is contained in an outer vacuum jacket to ensure thermal stability. During starting, the lamps have a strong red glow from the neon gas fill.The characteristic radiation from low-pressure sodium vapour is a monochromatic yellow. This is close to the peak sensitivity of the human eye, and low-pressure sodium lamps are the most efficient lamps available at nearly 200 lumens/watt. However the applications are limited to where colour discrimination is of no visual importance, such as trunk roads and underpasses, and residential streets.In many situations these lamps are being replaced by high-pressure sodium lamps. Their smaller size offers better optical control, particularly for roadway lighting where there is growing concern over excessive sky glow.

High-pressure sodium lamps

These lamps are similar to high-pressure mercury lamps but offer better efficacy (over 100 lumens/watt) and excellent lumen maintenance. The reactive nature of sodium requires the arc tube to be manufactured from translucent polycrystalline alumina, as glass or quartz are unsuitable. The outer glass bulb contains a vacuum to prevent arcing and oxidation. There is no UV radiation from the sodium discharge so phosphor coatings are of no value. Some bulbs are frosted or coated to diffuse the light source. See figure 8.

Figure 8. High-pressure sodium lamp construction



As the sodium pressure is increased, the radiation becomes a broad band around the yellow peak, and the appearance is golden white. However, as the pressure increases, the efficiency decreases. There are currently three separate types of high-pressure sodium lamps available.

Lamp type (code)	Colour (K)	Efficacy (lumens/watt)	Life (hours)
Standard	2,000	110	24,000
Deluxe	2,200	80	14,000
White (SON)	2,500	50	

Generally the standard lamps are used for exterior lighting, deluxe lamps for industrial interiors, and White SON for commercial/display applications.

Dimming of Discharge Lamps

The high-pressure lamps cannot be satisfactorily dimmed, as changing the lamp power changes the pressure and thus the fundamental characteristics of the lamp.

Fluorescent lamps can be dimmed using high-frequency supplies generated typically within the electronic control gear. The colour appearance remains very constant. In addition, the light output is approximately proportional to the lamp power, with consequent saving in electrical power when the light output is reduced. By integrating the light output from the lamp with the prevailing level of natural daylight, a near constant level of illuminance can be provided in an interior.

Lamp

Commonly called 'light bulbs', lamps are the removable and replaceable part of a light fixture, which converts electrical energy into electromagnetic radiation. While lamps have traditionally been rated and marketed primarily in terms of their power consumption, expressed in watts, proliferation of lighting technology beyond the incandescent light bulb has eliminated the correspondence of wattage to the amount of light produced. For example, a 60 W incandescent light bulb produces about the same amount of light as a 13 Wcompact fluorescent lamp. Each of

these technologies has a different efficacy in converting electrical energy to visible light. Visible light output is typically measured in lumens. This unit only quantifies the visible radiation, and excludes invisible infrared and ultraviolet light. A wax candle produces on the close order of 13 lumens, a 60 watt incandescent lamp makes around 700 lumens, and a 15-watt compact fluorescent lamp produces about 800 lumens, but actual output varies by specific design. Rating and marketing emphasis is shifting away from wattage and towards lumen output, to give the purchaser a directly applicable basis upon which to select a lamp.
Lamp types include:

- Ballast: A ballast is an auxiliary piece of equipment designed to start and properly control the flow of power to discharge light sources such as fluorescent and high intensity discharge (HID) lamps. Some lamps require the ballast to have thermal protection.
- Fluorescent light: A tube coated with phosphor containing low pressure mercury vapor that produces white light.
- Halogen: Incandescent lamps containing halogen gases such as iodine or bromine, increasing the efficacy of the lamp versus a plain incandescent lamp.
- Neon: A low pressure gas contained within a glass tube; the color emitted depends on the gas.
- Light emitting diodes: Light emitting diodes (LED) are solid state devices that emit light by dint of the movement of electrons in a semiconductor material.
- Compact fluorescent lamps: CFLs are designed to replace incandescent lamps in existing and new installations.[

incandescent lamps, fluorescent lamps, other gas discharged lamps, illumination and units of illumination.

13.4 External Lighting Types

Types of electric lighting include:

- incandescent light bulbs
- arc lamps
- gas-discharge lamps, e.g., fluorescent lights and compact fluorescent lamps, neon lamps, flood lamps, modern photographic flashes
- lasers
- light-emitting diodes, including OLEDs
- sulfur lamps

Different types of lights have vastly differing efficiencies and color of light.

Name	**Optical spectrum**	**Nominal** efficiency **(lm/W)**	**Lifetime (MTTF) (hours)**	**Color temperature** (Kelvin)	**Colour**	**Color rendering index**
Incandescent light bulb	Continuous	4-17	2-20000	2400-3400	Warm white (yellowish)	100
Halogen lamp	Continuous	16-23	3000-6000	3200	Warm white (yellowish)	100
Fluorescent lamp	Mercury line +Phosphor	52-100 (white)	8000-20000	2700-5000*	White (various color temperatures), as well as saturated colors available	15-85
Metal halide lamp	Quasi-continuous	50-115	6000-20000	3000-4500	Cold white	65-93
Sulfur lamp	Continuous	80-110	15000-20000	6000	Pale green	79
High pressure sodium	Broadband	55-140	10000-40000	1800-2200*	Pinkish orange	0-70
Low pressure sodium	Narrow line	100-200	18000-20000	1800*	Yellow, no color rendering	0
Light-emitting	Line plus phosphor	10-110 (white)	50,000-100,000	Various white from 2700 to	Various color temperatures, as	70-85 (white)

diode				6000*	well as saturated colors	
Induction Lamp (External Coil)	Mercury line +Phosphor	70-90 (white)	80,000-100,000	Various white from 2700 to 6000*	Various color temperatures, as well as saturated colors	70-85 (white)

*Color temperature is defined as the temperature of a black body emitting a similar spectrum; these spectra are quite different from those of black bodies.

The most efficient source of electric light is the low-pressure sodium lamp. It produces, for all practical purposes, a monochromatic orange/yellow light, which gives a similarly monochromatic perceprtion of any illuminated scene. For this reason, it is generally reserved for outdoor public lighting usages. Low-pressure sodium lights are favoured for public lighting by astronomers, since the light pollution that they generate can be easily filtered, contrary to broadband or continuous spectra.

13.5 Question

1. How many types of lighting?
2. Write about the different lighting devices?
3. What is the form of lighting?
4. Explain the high pressure sodium lamp?

13.6 Reference

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2. Hotel, Hostel & Hospital House Keeping, Joan C. Branson & Margaret Lennox,
3. Professional Management of Housekeeping Operations, Martin Jones, Wiley
4. Hotel Housekeeping Operations and Management, G.Raghubalan and Smiriti Raghubalan
5. Hotel Housekeeping Management and Operations,Sudhir Andrews,Tata McGraw Hill

UNIT 14

WASTE DISPOSAL AND POLLUTION CONTROL

Structure

14.0 Objectives

- Student know about Solid and liquid waste.
- Student know about sullage and sewage.
- Student know about the disposal of solid waste.
- Student know about Sewage treatment.
- Student know about Pollution related to hotel industry.

14.1 Introduction

Pollution and the growing volumes of solid and hazardous wastes are major threats to the environments and sustainable development of the Pacific islands. Globalization is accelerating the transition of Pacific communities towards consumer economies, with increasing urbanization, migration, and participation in international trade. This is resulting in an escalation in the generation of solid and liquid wastes, and these increase the risk of coastal and marine pollution. The lack of controls on imported chemicals and the lack of capacity for managing pollutants threaten to undermine the quality and health of vulnerable ecosystems on which Pacific islanders depend.

SPREP is mandated to take action on waste management and the control of pollution. The Secretariat's focus is to improve Members' technical capacity to manage pollution, solid wastes and hazardous chemicals through provision of training, technical advice and support. SPREP also encourages the development of national and regional waste management infrastructure and innovative funding measures, and the sharing of best practices across the region in order to support environmentally sound and sustainable waste management and reduce pollution. SPREP also supports renewed efforts in educating communities through national and other targeted awareness campaigns. With the support of bilateral and multilateral partnerships, the goal is for all members to have national waste management and pollution control policies, strategies, plans and practices in place to minimize terrestrial, atmospheric and marine

pollution, hazardous waste, solid waste and other land-based sources of pollution.

14.2 Solid and Liquid Waste

Solid Waste Disposal, disposal of normally solid or semisolid materials, resulting from human and animal activities, that are useless, unwanted, or hazardous. Solid wastes typically may be classified as follows:

Garbage: decomposable wastes from food

Rubbish: no decomposable wastes, either combustible (such as paper, wood, and cloth) or noncombustible (such as metal, glass, and ceramics)

Ashes: residues of the combustion of solid fuels

Large wastes: demolition and construction debris and trees

Dead animals

Sewage-treatment solids: material retained on sewage-treatment screens, settled solids, and biomass sludge

Industrial wastes: such materials as chemicals, paints, and sand

Mining wastes: slag heaps and coal refuse piles

Agricultural wastes: farm animal manure and crop residues.

Disposal of solid wastes on land is by far the most common method in the U.S. and probably accounts for more than 90 percent of the nation's municipal refuse. Incineration accounts for most of the remainder, whereas composting of solid wastes accounts for only an insignificant amount. Selecting a disposal method depends almost entirely on costs, which in turn are likely to reflect local circumstances.

A Landfill

Sanitary landfill is the cheapest satisfactory means of disposal, but only if suitable land is within economic range of the source of the wastes; typically, collection and transportation account for 75 percent of the total cost of solid waste management. In a modern landfill, refuse is spread in thin layers, each of which is compacted by a bulldozer before the next is spread. When about 3 m (about 10 ft) of refuse has been laid down, it is covered by a thin layer of clean earth, which also is compacted. Pollution of surface and groundwater is minimized by lining and contouring the fill, compacting and planting the cover, selecting proper soil, diverting upland drainage, and placing wastes in sites not subject to flooding or high groundwater levels. Gases are generated in landfills through anaerobic decomposition of organic solid waste. If a significant amount of methane is present, it may be explosive; proper venting eliminates this problem.

B Incinerators

In incinerators of conventional design, refuse is burned on moving grates in refractory-lined chambers; combustible gases and the solids they carry are burned in secondary chambers. Combustion is 85 to 90 percent complete for the combustible materials. In addition to heat, the products of incineration include the normal primary products of combustion—carbon dioxide and water—as well as oxides of sulfur and nitrogen and other gaseous pollutants; nongaseous products are fly ash and unburned solid residue. Emissions of fly ash and other particles are often controlled by wet scrubbers, electrostatic precipitators, and bag filters.

C Composting

Composting operations of solid wastes include preparing refuse and degrading organic matter by aerobic microorganisms. Refuse is presorted, to remove materials that might have salvage value or cannot be composted, and is ground up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to a humus with a total nitrogen, phosphorus, and potassium content of 1 to 3 percent, depending on the material being composted. After about three weeks, the product is ready for curing, blending with additives, bagging, and marketing.

D Resource Recovery

Numerous thermal processes, now in various stages of development, recover energy in one form or another from solid waste. These systems fall into two groups: combustion processes and pyrolysis processes. A number of companies burn in-plant wastes in conventional incinerators to produce steam. A few municipalities produce steam in incinerators in which the walls of the combustion chamber are lined with boiler tubes; the water circulated through the tubes absorbs heat generated in the combustion chamber and produces steam.

Pyrolysis, also called destructive distillation, is the process of chemically decomposing solid wastes by heat in an oxygen-reduced atmosphere. This results in a gas stream containing primarily hydrogen, methane, carbon monoxide, carbon dioxide, and various other gases and inert ash, depending on the organic characteristics of the material being pyrolyzed.

E Recycling

The practice of recycling solid waste is an ancient one. Metal implements were melted down and recast in prehistoric times. Today, recyclable materials are recovered from municipal refuse by a number of methods, including shredding, magnetic separation of metals, air classification that separates light and heavy fractions, screening, and washing. Another method of recovery is the wet pulping process: Incoming refuse is mixed with water and ground into a slurry in the wetpulper, which resembles a large kitchen disposal unit. Large pieces of metal and other nonpulpable materials are pulled out by a magnetic device before the slurry from the pulper is loaded into a centrifuge called a liquid cyclone. Here the heavier noncombustibles, such as glass, metals, and ceramics, are separated out and sent on to a glass- and metal-recovery system; other, lighter materials go to a paper-fiber-recovery system. The final residue is either incinerated or is used as landfill.

Increasingly, municipalities and private refuse-collection organizations are requiring those who generate solid waste to keep bottles, cans, newspapers, cardboard, and other recyclable items separate from other waste. Special trucks pick up this waste and cart it to transfer stations or directly to recycling facilities, thus lessening the load at incinerators and landfills.

F HAZARDOUS WASTES

Hazardous wastes have been defined by the federal Environmental Protection Agency as wastes that pose a potential hazard to humans or other living organisms for one or more of the following reasons: (1) Such wastes are nondegradable or persistent in nature; (2) their effects can be magnified by organisms in the environment; (3) they can be lethal; or (4) they may cause detrimental cumulative effects. General categories of hazardous wastes include toxic chemicals and flammable, radioactive, or biological substances. These wastes can be in the form of sludge, liquid, or gas, and solid.

Radioactive substances are hazardous because prolonged exposure to ionizing radiation often results in damage to living organisms (*see* Radiation Effects, Biological), and the substances may persist over long periods of time. Management of radioactive and other hazardous wastes is subject to federal and state regulation, but no satisfactory method has yet been demonstrated for disposing permanently of radioactive wastes.

14.3 Sullage and Sewage

Greywater or **sullage** is defined as wastewater generated from wash hand basins, showers and baths, which can be recycled on-site for uses such as toilet flushing, landscape irrigation and constructed wetlands. Greywater often also includes waste water from clothes washing machines but doesn't include discharge from dishwashers and kitchen sinks. It differs from the discharge of toilets which is designated sewage or blackwater to indicate it contains human waste.Sullage is a term used to describe wastewater that arises as a byproduct of daily human activities such as showering, washing dishes, and doing the laundry. It's also commonly referred to as gray water. Much of this gray water can be recycled and reintroduced into the environment instead of just being disposed of. Environmental experts have claimed that reusing gray water will have a great beneficial impact on fresh water supply over time.

Wastewater is an umbrella term used to describe all liquid wastes, treated and untreated. The term can be further broken down into the two categories of sullage, better known as gray water, and effluent, better known as black water. Sullage, or gray water, is a mixture of water, soap, detergent, bleach, dirt, and other compounds discarded after use. Effluent, or black water, is a mixture of water and sewage undergoing a treatment process. In other words, sullage is any leftover water from use in the home except for the toilet.

It's estimated that up to 80 percent of all household wastewater is sullage. Many see this as a waste of water that could potentially be reused. Ecological experts claim reusing wastewater is not only better for the environment, but will also be vital in solving the planet's predicted water shortages. By reusing it, the population can lower the consumption of fresh water, replace vital nutrients in the soil, promote plant growth, and lower the amount of chemicals used in treatment plants.

14.4 Disposal Of Solid Waste

Landfill

Disposal of waste in a landfill involves burying the waste and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills and open dumps can create a number of adverse environmental impacts such as wind-blownlitter, attraction of vermin, and generation of liquid leachate. Another common product of landfills is gas (mostly composed of methane and carbon dioxide), which is produced from anaerobic breakdown of organic waste. This gas can create odor problems, kill surface vegetation and is a greenhouse gas.

Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability and covered to prevent attracting vermin (such as mice orrats). Many landfills also have landfill gas extraction systems installed to extract thelandfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

Incineration

Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash.

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organic compounds such as dioxins, furans, and PAHs, which may be created and which may have serious environmental consequences.

Recycling

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, a procedure called kerbside collection. In some communities, the owner of the waste is required to separate the materials into various different bins (e.g. for paper, plastics, metals) prior to its collection. In other communities, all recyclable materials are placed in a single bin for collection, and the sorting is handled later at a central facility. The latter method is known as "single-stream recycling.

The most common consumer products recycled include aluminium such as beverage cans, copper such as wire, steel from food and aerosol cans, old steel furnishings or equipment, polyethylene and PET bottles, glass bottles and jars,paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes.

PVC, LDPE, PP, and PS are also recyclable. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required.

The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale value of the material once it is reprocessed.

Sustainability

The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainability-related activities. One way to do this is by shifting away from waste management to resource recovery practices like recycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal.

Biological reprocessing

Recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat (CHP/cogeneration) maximising

efficiencies. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter.

Energy recovery

Energy recovery from waste is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas recovery. This process is often called waste-to-energy. Energy recovery from waste is part of the non-hazardous waste management hierarchy. Using energy recovery to convert non-recyclable waste materials into electricity and heat, generates a renewable energy source and can reduce carbon emissions by offsetting the need for energy from fossil sources as well as reduce methane generation from landfills. Globally, waste-to-energy accounts for 16% of waste management.

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Thermal treatment ranges from using waste as a fuel source for cooking or heating and the use of the gas fuel (see above), to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation).

Resource recovery

Resource recovery is the systematic diversion of waste, which was intended for disposal, for a specific next use It is the processing of recyclables to extract or recover materials and resources, or convert to energy. These activities are performed at a resource recovery facility. Resource recovery is not only environmentally important, but it is also cost effective. It decreases the amount of waste for disposal, saves space in landfills, and conserves natural resources.

Resource recovery (as opposed to waste management) uses LCA (life cycle analysis) attempts to offer alternatives to waste management. For mixed MSW (Municipal Solid Waste) a number of broad studies have indicated that administration, source separation and collection followed by reuse and recycling of the non-organic fraction and energy and compost/fertilizer production of the organic material via anaerobic digestion to be the favoured path.

Avoidance and reduction methods

An important method of waste management is the prevention of waste material being created, also known as waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery), removing any food/liquid remains from cans and packaging, and designing products that use less material to achieve the same purpose (for example, lightweighting of beverage cans).

14.5 Sewage Treatment

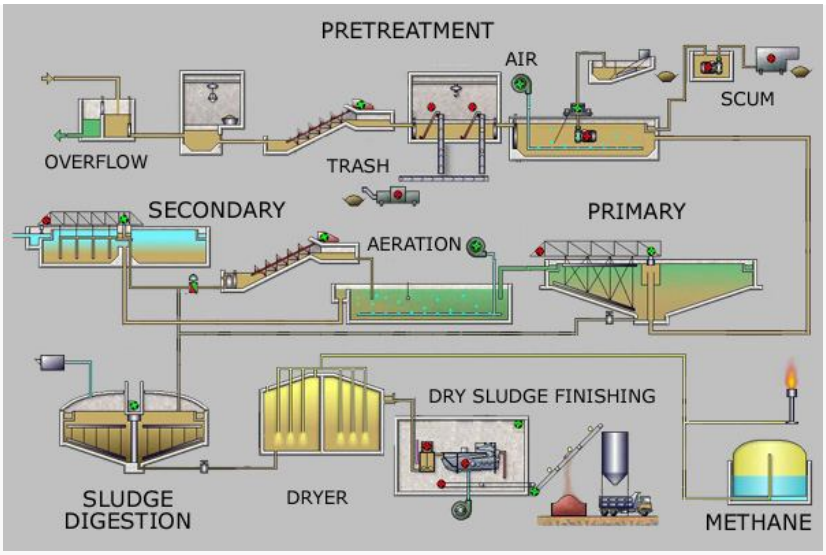
Sewage treatment is the process of removing contaminants from wastewater, including household sewage and runoff (effluents). It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). With suitable technology, it is possible to re-use sewage effluent for drinking water, although this is usually only done in places with limited water supplies, such as Dubai and Singapore.

Sewage can be treated close to where the sewage is created, a decentralized system (in septic tanks, biofilters or aerobic treatment systems), or be collected and transported by a network of pipes and pump stations to a municipal treatment plant, a centralized system (see sewerage and pipes and infrastructure). Sewage collection and treatment is typically subject to local, state and federal regulations and standards. Industrial sources of sewage often require specialized treatment processes (see Industrial wastewater treatment).

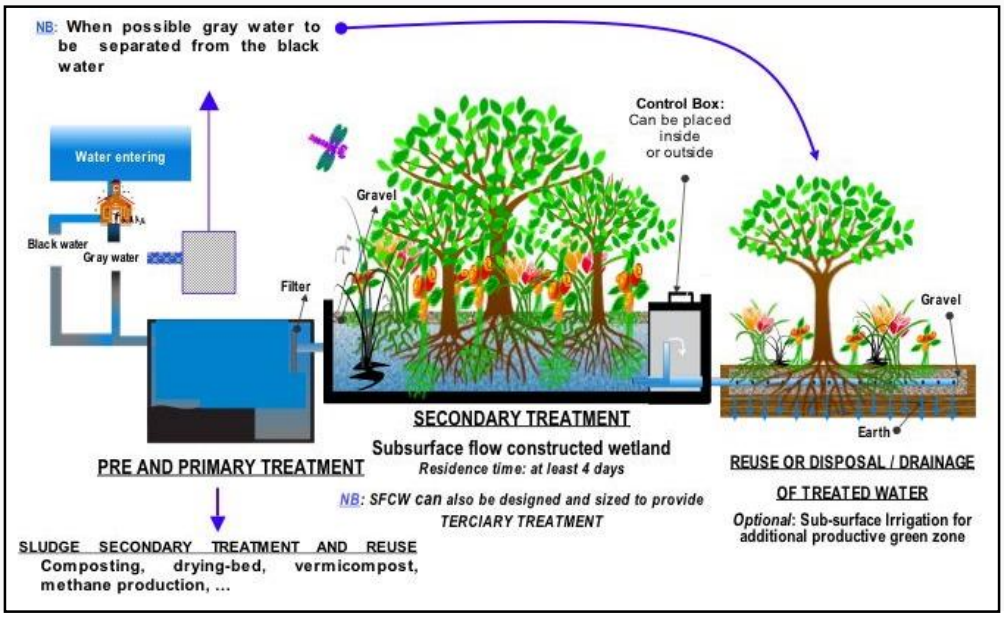
Sewage treatment generally involves three stages, called primary, secondary and tertiary treatment.

- *Primary treatment* consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.
- *Secondary treatment* removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.
- *Tertiary treatment* is sometimes defined as anything more than primary and secondary treatment in order to allow rejection into a highly sensitive or fragile ecosystem (estuaries, low-flow rivers, coral reefs,...). Treated water is sometimes disinfected chemically or physically (for example, by lagoons and microfiltration) prior to discharge into

astream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, green way or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.



Simplified process flow diagram for a typical large-scale treatment plant



Process flow diagram for a typical treatment plant via subsurface flow constructed wetlands (SFCW)

Pretreatment

Pretreatment removes all materials that can be easily collected from the raw sewage before they damage or clog the pumps and sewage lines of primary treatment clarifiers. Objects that are

commonly removed during pretreatment include trash, tree limbs, leaves, branches, and other large objects.

The influent in sewage water passes through a bar screen to remove all large objects like cans, rags, sticks, plastic packets etc. carried in the sewage stream. This is most commonly done with an automated mechanically raked bar screen in modern plants serving large populations, while in smaller or less modern plants, a manually cleaned screen may be used. The raking action of a mechanical bar screen is typically paced according to the accumulation on the bar screens and/or flow rate. The solids are collected and later disposed in a landfill, or incinerated. Bar screens or mesh screens of varying sizes may be used to optimize solids removal. If gross solids are not removed, they become entrained in pipes and moving parts of the treatment plant, and can cause substantial damage and inefficiency in the process.

Grit removal

Pretreatment may include a sand or grit channel or chamber, where the velocity of the incoming sewage is adjusted to allow the settlement of sand, grit, stones, and broken glass. These particles are removed because they may damage pumps and other equipment. For small sanitary sewer systems, the grit chambers may not be necessary, but grit removal is desirable at larger plants.Grit chambers come in 3 types: horizontal grit chambers, aerated grit chambers and vortex grit chambers.

Flow equalization

Clarifiers and mechanized secondary treatment are more efficient under uniform flow conditions. Equalization basins may be used for temporary storage of diurnal or wet-weather flow peaks. Basins provide a place to temporarily hold incoming sewage during plant maintenance and a means of diluting and distributing batch discharges of toxic or high-strength waste which might otherwise inhibit biological secondary treatment (including portable toilet waste, vehicle holding tanks, and septic tank pumpers). Flow equalization basins require variable discharge control, typically include provisions for bypass and cleaning, and may also include aerators. Cleaning may be easier if the basin is downstream of screening and grit removal.

Fat and grease removal

In some larger plants, fat and grease are removed by passing the sewage through a small tank where skimmers collect the fat floating on the surface. Air blowers in the base of the tank may also be used to help recover the fat as a froth. Many plants, however, use primary clarifiers with mechanical surface skimmers for fat and grease removal.

Primary treatment

In the primary sedimentation stage, sewage flows through large tanks, commonly called "pre-settling basins", "primary sedimentation tanks" or "primary clarifiers". The tanks are used to

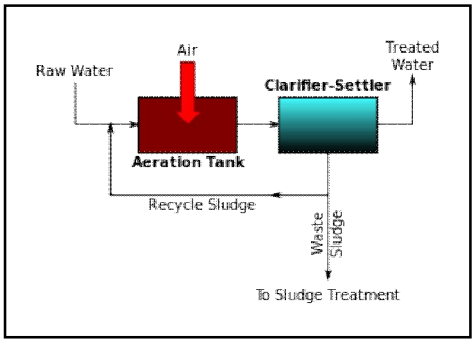
settle sludge while grease and oils rise to the surface and are skimmed off. Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank where it is pumped to sludge treatment facilities. Grease and oil from the floating material can sometimes be recovered for saponification (soap making).

Secondary treatment

Secondary treatment is designed to substantially degrade the biological content of the sewage which are derived from human waste, food waste, soaps and detergent. The majority of municipal plants treat the settled sewage liquor using aerobic biological processes. To be effective, the biota require both oxygen and food to live. The bacteria and protozoa consume biodegradable soluble organic contaminants (e.g. sugars, fats, organic short-chain carbon molecules, etc.) and bind much of the less soluble fractions into floc. Secondary treatment systems are classified as *fixed-film* or *suspended-growth* systems.

- **Fixed-film** or **attached growth** systems include trickling filters, bio-towers, and rotating biological contactors, where the biomass grows on media and the sewage passes over its surface. The fixed-film principle has further developed into Moving Bed Biofilm Reactors (MBBR), and Integrated Fixed-Film Activated Sludge (IFAS) processes. An MBBR system typically requires smaller footprint than suspended-growth systems.
- **Suspended-growth** systems include activated sludge, where the biomass is mixed with the sewage and can be operated in a smaller space than trickling filters that treat the same amount of water. However, fixed-film systems are more able to cope with drastic changes in the amount of biological material and can provide higher removal rates for organic material and suspended solids than suspended growth systems.

Roughing filters are intended to treat particularly strong or variable organic loads, typically industrial, to allow them to then be treated by conventional secondary treatment processes. Characteristics include filters filled with media to which wastewater is applied. They are designed to allow high hydraulic loading and a high level of aeration. On larger installations, air is forced through the media using blowers. The resultant wastewater is usually within the normal range for conventional treatment processes.



A generalized schematic of an activated sludge process.

A filter removes a small percentage of the suspended organic matter, while the majority of the organic matter undergoes a change of character, only due to the biological oxidation and nitrification taking place in the filter. With this aerobic oxidation and nitrification, the organic solids are converted into coagulated suspended mass, which is heavier and bulkier, and can settle to the bottom of a tank. The effluent of the filter is therefore passed through a sedimentation tank, called a secondary clarifier, secondary settling tank or humus tank.

Activated sludge

In general, activated sludge plants encompass a variety of mechanisms and processes that use dissolved oxygen to promote the growth of biological floc that substantially removes organic material.

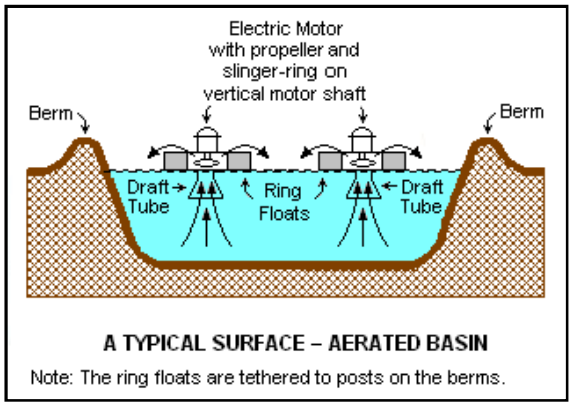
Biological floc, as mentioned above, is an ecosystem of living biota that subsists on nutrients from the inflowing primary settling tank (or clarifier) effluent. These mostly carbonaceous dissolved solids undergo aeration to be broken down and biologically oxidized or converted to carbon dioxide. Likewise, nitrogenous dissolved solids (amino acids, ammonia, etc.) are also oxidized (=eaten) by the floc to nitrites, nitrates, and, in some processes, to nitrogen gas through denitrification.

While denitrification is encouraged in some treatment processes, in many suspended aeration plants denitrification will impair the settling of the floc and lead to poor quality effluent.

In either case, the settled floc is both recycled to the inflowing primary effluent to regrow, or is partially 'wasted' (or diverted) to solids dewatering, or digesting, and then dewatering.

Interestingly, like most living creatures, activated sludge biota can get sick. This many times takes the form of the floating brown foam, Nocardia. While this so-called 'sewage fungus' (it isn't really a fungus) is the best known, there are many different fungi and protists that can overpopulate the floc and cause process upsets. Additionally, certain incoming chemical species, such as a heavy pesticide, a heavy metal (e.g.: plating company effluent) load, or extreme pH,

can kill the biota of an activated sludge reactor ecosystem. Such problems are tested for, and if caught in time, can be neutralized.



A typical surface-aerated basin (using motor-driven floating aerators)

Aerobic granular sludge

Activated sludge systems can be transformed into aerobic granular sludge systems (aerobic granulation) which enhance the benefits of activated sludge, like increased biomass retention due to high sludge settlability.

Surface-aerated basins (lagoons)

Many small municipal sewage systems in the United States (1 million gal./day or less) use aerated lagoons.

Most biological oxidation processes for treating industrial wastewaters have in common the use of oxygen (or air) and microbial action. Surface-aerated basins achieve 80 to 90 percent removal of BOD with retention times of 1 to 10 days.The basins may range in depth from 1.5 to 5.0 metres and use motor-driven aerators floating on the surface of the wastewater.

In an aerated basin system, the aerators provide two functions: they transfer air into the basins required by the biological oxidation reactions, and they provide the mixing required for dispersing the air and for contacting the reactants (that is, oxygen, wastewater and microbes). Typically, the floating surface aerators are rated to deliver the amount of air equivalent to 1.8 to 2.7 kg O_2/kW·h. However, they do not provide as good mixing as is normally achieved in activated sludge systems and therefore aerated basins do not achieve the same performance level as activated sludge units.

Biological oxidation processes are sensitive to temperature and, between 0 °C and 40 °C, the rate of biological reactions increase with temperature. Most surface aerated vessels operate at between 4 °C and 32 °C.

Filter beds (oxidizing beds)

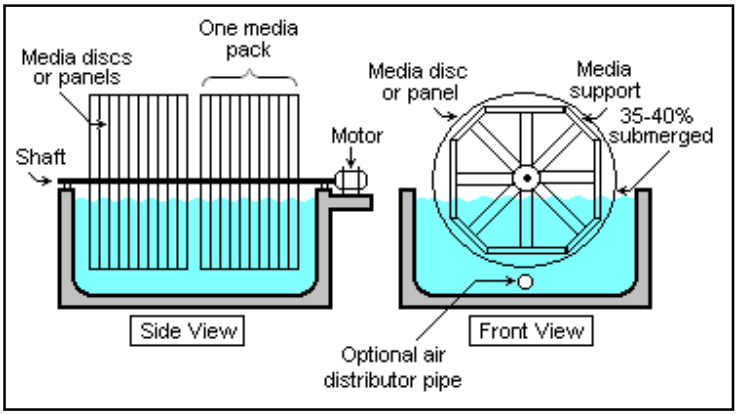
In older plants and those receiving variable loadings, trickling filter beds are used where the settled sewage liquor is spread onto the surface of a bed made up of coke (carbonized coal), limestone chips or specially fabricated plastic media. Such media must have large surface areas to support the biofilms that form. The liquor is typically distributed through perforated spray arms. The distributed liquor trickles through the bed and is collected in drains at the base. These drains also provide a source of air which percolates up through the bed, keeping it aerobic. Biological films of bacteria, protozoa and fungi form on the media's surfaces and eat or otherwise reduce the organic content This biofilm is often grazed by insect larvae, snails, and worms which help maintain an optimal thickness. Overloading of beds increases the thickness of the film leading to clogging of the filter media and ponding on the surface. Recent advances in media and process micro-biology design overcome many issues with trickling filter designs.

Constructed wetlands

Constructed wetlands(can either be surface flow or subsurface flow, horizontal or vertical flow), include engineeredreedbeds and belong to the family of phytorestoration and ecotechnologies; they provide a high degree of biological improvement and depending on design, act as a primary, secondary and sometimes tertiary treatment, also seephytoremediation. One example is a small reedbed used to clean the drainage from the elephants' enclosure at Chester Zoo in England; numerous CWs are used to recycle the water of the city of Honfleur in France and numerous other towns in Europe, the US, Asia and Australia. They are known to be highly productive systems as they copy natural wetlands, called the "kidneys of the earth" for their fundamental recycling capacity of the hydrological cycle in the biosphere. Robust and reliable, their treatment capacities improve as time goes by, at the opposite of conventional treatment plants whose machinery ages with time. They are being increasingly used, although adequate and experienced design are more fundamental than for other systems and space limitation may impede their use.

Biological aerated filters

Biological Aerated (or Anoxic) Filter (BAF) or Biofilters combine filtration with biological carbon reduction, nitrification or denitrification. BAF usually includes a reactor filled with a filter media. The media is either in suspension or supported by a gravel layer at the foot of the filter. The dual purpose of this media is to support highly active biomass that is attached to it and to filter suspended solids. Carbon reduction and ammonia conversion occurs in aerobic mode and sometime achieved in a single reactor while nitrate conversion occurs in anoxic mode. BAF is operated either in upflow or downflow configuration depending on design specified by manufacturer.



Schematic of a typical rotating biological contactor (RBC). The treated effluent clarifier/settler is not included in the diagram.

Rotating biological contactors

Rotating biological contactors (RBCs) are mechanical secondary treatment systems, which are robust and capable of withstanding surges in organic load. RBCs were first installed in Germany in 1960 and have since been developed and refined into a reliable operating unit. The rotating disks support the growth of bacteria and micro-organisms present in the sewage, which break down and stabilize organic pollutants. To be successful, micro-organisms need both oxygen to live and food to grow. Oxygen is obtained from the atmosphere as the disks rotate. As the micro-organisms grow, they build up on the media until they are sloughed off due to shear forces provided by the rotating discs in the sewage. Effluent from the RBC is then passed through final clarifiers where the micro-organisms in suspension settle as a sludge. The sludge is withdrawn from the clarifier for further treatment.

A functionally similar biological filtering system has become popular as part of home aquarium filtration and purification. The aquarium water is drawn up out of the tank and then cascaded over a freely spinning corrugated fiber-mesh wheel before passing through a media filter and back into the aquarium. The spinning mesh wheel develops a biofilm coating of microorganisms that feed on the suspended wastes in the aquarium water and are also exposed to the atmosphere as the wheel rotates. This is especially good at removing waste urea and ammonia urinated into the aquarium water by the fish and other animals.

Membrane bioreactors

Membrane bioreactors (MBR) combine activated sludge treatment with a membrane liquid-solid separation process. The membrane component uses low pressure microfiltration or ultra filtration membranes and eliminates the need for clarification and tertiary filtration. The membranes are typically immersed in the aeration tank; however, some applications utilize a separate membrane tank. One of the key benefits of an MBR system is that it effectively

overcomes the limitations associated with poor settling of sludge in conventional activated sludge (CAS) processes. The technology permits bioreactor operation with considerably higher mixed liquor suspended solids (MLSS) concentration than CAS systems, which are limited by sludge settling. The process is typically operated at MLSS in the range of 8,000–12,000 mg/L, while CAS are operated in the range of 2,000–3,000 mg/L. The elevated biomass concentration in the MBR process allows for very effective removal of both soluble and particulate biodegradable materials at higher loading rates. Thus increased sludge retention times, usually exceeding 15 days, ensure complete nitrification even in extremely cold weather.

The cost of building and operating an MBR is often higher than conventional methods of sewage treatment. Membrane filters can be blinded with grease or abraded by suspended grit and lack a clarifier's flexibility to pass peak flows. The technology has become increasingly popular for reliably pretreated waste streams and has gained wider acceptance where infiltration and inflow have been controlled, however, and the life-cycle costs have been steadily decreasing. The small footprint of MBR systems, and the high quality effluent produced, make them particularly useful for water reuse applications.

Secondary sedimentation

Secondary sedimentation tank at a rural treatment plant.

The final step in the secondary treatment stage is to settle out the biological floc or filter material through a secondary clarifier and to produce sewage water containing low levels of organic material and suspended matter.

Tertiary treatment

The purpose of tertiary treatment is to provide a final treatment stage to further improve the effluent quality before it is discharged to the receiving environment (sea, river, lake, wet lands, ground, etc.). More than one tertiary treatment process may be used at any treatment plant. If disinfection is practised, it is always the final process. It is also called "effluent polishing."

Filtration

Sand filtration removes much of the residual suspended matter. Filtration over activated carbon, also called *carbon adsorption,* removes residual toxins.

Lagooning

Lagooning provides settlement and further biological improvement through storage in large man-made ponds or lagoons. These lagoons are highly aerobic and colonization by native macrophytes, especially reeds, is often encouraged. Small filter feeding invertebrates such as *Daphnia* and species of *Rotifera* greatly assist in treatment by removing fine particulates.

Nutrient removal

Wastewater may contain high levels of the nutrients nitrogen and phosphorus. Excessive release to the environment can lead to a buildup of nutrients, called eutrophication, which can in turn encourage the overgrowth of weeds, algae, andcyanobacteria (blue-green algae). This may cause an algal bloom, a rapid growth in the population of algae. The algae numbers are unsustainable and eventually most of them die. The decomposition of the algae by bacteria uses up so much of the oxygen in the water that most or all of the animals die, which creates more organic matter for the bacteria to decompose. In addition to causing deoxygenation, some algal species produce toxins that contaminate drinking water supplies. Different treatment processes are required to remove nitrogen and phosphorus.

Nitrogen removal

Nitrogen is removed through the biological oxidation of nitrogen from ammonia to nitrate (nitrification), followed bydenitrification, the reduction of nitrate to nitrogen gas. Nitrogen gas is released to the atmosphere and thus removed from the water.

Nitrification itself is a two-step aerobic process, each step facilitated by a different type of bacteria. The oxidation of ammonia (NH_3) to nitrite (NO_2^-) is most often facilitated by *Nitrosomonas* spp. ("nitroso" referring to the formation of anitroso functional group). Nitrite oxidation to nitrate (NO_3^-), though traditionally believed to be facilitated by *Nitrobacter* spp. (nitro referring the formation of a nitro functional group), is now known to be facilitated in the environment almost exclusively by *Nitrospira* spp.

Denitrification requires anoxic conditions to encourage the appropriate biological communities to form. It is facilitated by a wide diversity of bacteria. Sand filters, lagooning and reed beds can all be used to reduce nitrogen, but the activated sludge process (if designed well) can do the job the most easily. Since denitrification is the reduction of nitrate to dinitrogen (molecular nitrogen) gas, an electron donor is needed. This can be, depending on the wastewater, organic matter (from faeces), sulfide, or an added donor like methanol. The sludge in the anoxic tanks (denitrification

tanks) must be mixed well (mixture of recirculated mixed liquor, return activated sludge [RAS], and raw influent) e.g. by using submersible mixers in order to achieve the desired denitrification.

Sometimes the conversion of toxic ammonia to nitrate alone is referred to as tertiary treatment.

Many sewage treatment plants use centrifugal pumps to transfer the nitrified mixed liquor from the aeration zone to the anoxic zone for denitrification. These pumps are often referred to as *Internal Mixed Liquor Recycle* (IMLR) pumps.

The bacteria Brocadia anammoxidans, is being researched for its potential in sewage treatment. It can remove nitrogen from waste water. In addition the bacteria can perform the anaerobic oxidation of ammonium and can produce the rocket fuel hydrazine from waste water.

Phosphorus removal

Each person excretes between 200 and 1000 grams of phosphorus annually. Studies of United States sewage in the late 1960s estimated mean per capita contributions of 500 grams in urine and feces, 1000 grams in synthetic detergents, and lesser variable amounts used as corrosion and scale control chemicals in water supplies. Source control via alternative detergent formulations has subsequently reduced the largest contribution, but the content of urine and feces will remain unchanged. Phosphorus removal is important as it is a limiting nutrient for algae growth in many fresh water systems. It is also particularly important for water reuse systems where high phosphorus concentrations may lead to fouling of downstream equipment such as reverse osmosis.

Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. In this process, specific bacteria, called polyphosphate-accumulating organisms (PAOs), are selectively enriched and accumulate large quantities of phosphorus within their cells (up to 20 percent of their mass). When the biomass enriched in these bacteria is separated from the treated water, these biosolids have a high fertilizer value.

Phosphorus removal can also be achieved by chemical precipitation, usually with salts of iron (e.g. ferric chloride),aluminum (e.g. alum), or lime This may lead to excessive sludge production as hydroxides precipitates and the added chemicals can be expensive. Chemical phosphorus removal requires significantly smaller equipment footprint than biological removal, is easier to operate and is often more reliable than biological phosphorus removal. Another method for phosphorus removal is to use granular laterite.

Once removed, phosphorus, in the form of a phosphate-rich sludge, may be stored in a land fill or resold for use in fertilizer.

Disinfection

The purpose of disinfection in the treatment of waste water is to substantially reduce the number of microorganisms in the water to be discharged back into the environment for the later use of drinking, bathing, irrigation, etc. The effectiveness of disinfection depends on the quality of the water being treated (e.g., cloudiness, pH, etc.), the type of disinfection being used, the disinfectant dosage (concentration and time), and other environmental variables. Cloudy water will be treated less successfully, since solid matter can shield organisms, especially from ultraviolet light or if contact times are low. Generally, short contact times, low doses and high flows all militate against effective disinfection. Common methods of disinfection include ozone, chlorine, ultraviolet light, or sodium hypochlorite. Chloramine, which is used for drinking water, is not used in the treatment of waste water because of its persistence. After multiple steps of disinfection, the treated water is ready to be released back into the water cycle by means of the nearest body of water or agriculture. Afterwards, the water can be transferred to reserves for everyday human uses.

Chlorination remains the most common form of waste water disinfection in North America due to its low cost and long-term history of effectiveness. One disadvantage is that chlorination of residual organic material can generate chlorinated-organic compounds that may be carcinogenic or harmful to the environment. Residual chlorine or chloramines may also be capable of chlorinating organic material in the natural aquatic environment. Further, because residual chlorine is toxic to aquatic species, the treated effluent must also be chemically dechlorinated, adding to the complexity and cost of treatment.

Ultraviolet (UV) light can be used instead of chlorine, iodine, or other chemicals. Because no chemicals are used, the treated water has no adverse effect on organisms that later consume it, as may be the case with other methods. UV radiation causes damage to the genetic structure of bacteria, viruses, and other pathogens, making them incapable of reproduction. The key disadvantages of UV disinfection are the need for frequent lamp maintenance and replacement and the need for a highly treated effluent to ensure that the target microorganisms are not shielded from the UV radiation (i.e., any solids present in the treated effluent may protect microorganisms from the UV light). In the United Kingdom, UV light is becoming the most common means of disinfection because of the concerns about the impacts of chlorine in chlorinating residual organics in the wastewater and in chlorinating organics in the receiving water. Some sewage treatment systems in Canada and the US also use UV light for their effluent water disinfection

Ozone (O_3) is generated by passing oxygen (O_2) through a high voltage potential resulting in a third oxygen atom becoming attached and forming O_3. Ozone is very unstable and reactive and oxidizes most organic material it comes in contact with, thereby destroying many pathogenic

microorganisms. Ozone is considered to be safer than chlorine because, unlike chlorine which has to be stored on site (highly poisonous in the event of an accidental release), ozone is generated on-site as needed. Ozonation also produces fewer disinfection by-products than chlorination. A disadvantage of ozone disinfection is the high cost of the ozone generation equipment and the requirements for special operators.

Odor control

Odors emitted by sewage treatment are typically an indication of an anaerobic or "septic" condition.Early stages of processing will tend to produce foul smelling gases, with hydrogen sulfide being most common in generating complaints. Large process plants in urban areas will often treat the odors with carbon reactors, a contact media with bio-slimes, small doses of chlorine, or circulating fluids to biologically capture and metabolize the noxious gases. Other methods of odor control exist, including addition of iron salts, hydrogen peroxide, calcium nitrate, etc. to manage hydrogen sulfide levels.

High-density solids pumps are suitable for reducing odors by conveying sludge through hermetic closed pipework.

14.6 Pollution Related To Hotel Industry

With the coming of the Industrial Revolution, humans were able to advance further into the 21st century. Technology developed rapidly, science became advanced and the manufacturing age came into view. With all of these came one more effect, industrial pollution. Early industries were small factories that produced smoke as the main pollutant. However, since the number of factories were limited and worked only a certain number of hours a day, the levels of pollution did not grow significantly. But when these factories became full scale industries and manufacturing units, the issue of industrial pollution started to take on more importance.

Any form of pollution that can trace its immediate source to industrial practices is known as industrial pollution. Most of the pollution on the planet can be traced back to industries of some kind. In fact, the issue of industrial pollution has taken on grave importance for agencies trying to fight against environmental degradation. Nations facing sudden and rapid growth of such industries are finding it to be a serious problem which has to be brought under control immediately.

Industrial pollution takes on many faces. It contaminates many sources of drinking water, released unwanted toxins into the air and reduces the quality of soil all over the world. Major environmental disasters have been caused due to industrial mishaps, which have yet to be brought under control. There are many different factors that comprise of the issue of industrial pollution.

Causes of Industrial Pollution

1. Lack of Policies to Control Pollution: Lack of effective policies and poor enforcement drive allowed many industries to bypass laws made by pollution control board which resulted in mass scale pollution that effected lives of many people.

2. Unplanned Industrial Growth: In most industrial townships, unplanned growth took place wherein those companies flouted rules and norms and polluted the environment with both air and water pollution.

3. Use of Outdated Technologies: Most industries still rely on old technologies to produce products that generate large amount of waste. To avoid high cost and expenditure, many companies still make use of traditional technologies to produce high end products.

4. Presence of Large Number of Small Scale Industries: Many small scale industries and factories that don't have enough capital and rely on government grants to run their day-to-day business often escape environment regulations and release large amount of toxic gases in the atmosphere.

5. Inefficient Waste Disposal: Water pollution and soil pollution are often caused directly due to inefficiency in disposal of waste. Long term exposure causes chronic health problems, making the issue of industrial pollution into a severe one. It also lowers the air quality in surrounding areas, causing many respiratory disorders.

6. Leaching of Resources From Our Natural World: Industries do require large amount of raw material to make them into finished products. This requires extraction of minerals from beneath the earth. It destroys the land used for mining and drilling, by removing all resources and leaving it to waste away, or through leaks and accidents that cause oil spills in both the land and the sea.

Effects of Industrial Pollution

1. Water Pollution: The effects of industrial pollution are far reaching and liable to affect the eco-system for many years to come. Most industries require large amounts of water for their work. When involved in a series of processes, the water comes into contact with heavy metals, harmful chemicals, radioactive waste and even organic sludge.

These are either dumped into open oceans or rivers, or the water that has been polluted by them is released into the ground. As a result, many of our water sources have trace amounts of industrial waste in them and it seriously impacts the health of our eco-system. This water is used for irrigation, washing our food at home and sometimes recycled into drinking water.

Water pollution has already rendered many ground water resources useless for humans and wildlife. It can at best be recycled for further usage in industries, which costs tremendous amounts of money.

2. Soil Pollution: Soil pollution is creating problems in agriculture and destroying local vegetation. It also causes chronic health issues for the people that come in contact with such soil on a daily basis.

3. Air Pollution: Air pollution has led to a steep increase in various illnesses and it continues to affect us on a daily basis. With so many small, mid and large scale industries coming up, air pollution has taken toll on the health of people.

4. Wildlife Extinction: By and large, the issue of industrial pollution shows us that it causes natural rhythms and patterns to fail, meaning that the wildlife is affected in a severe manner. Habitats are being lost, species are becoming extinct and it is harder for the environment to recover from each natural disaster. Major industrial accidents like oil spills, fires, leak of radioactive material and damage to property are harder to clean-up, since they have a higher impact in a shorter span of time.

5. Global Warming: With the rise in industrial pollution, global warming has been increasing at a steady pace. Smoke and greenhouse gases are released by the factories into the air, which causes an increase in the greenhouse effect and increase in global warming. Melting of glaciers, extinction of polar beers, floods, tsunamis, hurricanes are few of the effects of global warming.

The issue of industrial pollution concerns every nation on the planet. As a result, many steps have been taken to seek permanent solutions to the problem. Better technology is being developed for disposal of waste and recycling as much polluted water in the industries as possible. Organic methods are being employed to clean the water and soil, such as using microbes that naturally use heavy metals and waste as feed. Policies are being pushed into place to prevent further misuse of land. However, industrial pollution is still rampant and will take many years to be brought under control. It is suggested that assessment of the surrounding environment should be considered and incorporated at the planning stage in order to avoid the noise impact to the surrounding places (such as residential buildings, sanatoriums, nursing homes, hospitals and schools etc), and avoid complaints in the future.

1. The operations of such places must comply with the requirements of the law of Environmental Noise .

2. The noise generated from loudspeakers which will affect the surrounding residents should be highly concerned. If necessary, the relevant sound insulation / noise elimination and vibration isolation accessories should be installed to ensure the conformation with the requirements of the law of Environmental Noise

3. Avoid installing outdoor loudspeaker so as not to affect the surrounding residents.

4. The noise from air conditioners and venting facilities which will affect the surrounding residents should be highly concerned. If necessary, the relevant sound insulation / noise

elimination and vibration isolation accessories should be installed to ensure the conformation with the requirements of the law of Environmental Noise.

5. The placement of air conditioning, ventilation equipment, related machine room cooling system and venting outlets should be fully considered to avoid their impacts to nearby residents. The appropriate spatial distance should be kept between the mentioned equipment and the sensitive receptors (such as residential buildings, sanatoriums, nursing homes, hospitals and schools etc). They should be properly situated in order to ease the diffusion of noise and heat in open area and to alleviate their impacts to the surrounding environment. The above equipments should not be located at courtyards, narrow alleys or other airflow pathways that would inhibit diffusion. It is suggested that inspection, repair and maintenance of air conditioning system, cooling tower and ventilation systems inlets and outlets and other relative facilities should be regularly done in order to ensure their operations to comply with the requirements of the law of Environmental Noise . The position of establishing a business should be fully considered to avoid the noise nuisance and complaints to the surrounding sound sensitive districts (such as residential buildings) in the future. Karaoke, bars, discos, or pubs which have the potential to generate noise nuisance and complaints. Therefore, such establishments are not recommended to be established in residential buildings. They are suggested to be operated at hotels, pure entertainment buildings and pure commercial buildings to reduce the opportunities to generate nuisance and complains in the future.

6. The environmental capacity of a district where the above mentioned establishments are to be operated should be considered to avoid relevant environmental noise problems. It is suggested that only a limit amount of such establishments is allowed to be operated in a certain district so as to avoid relevant noise nuisance and complaints.

7. The above establishments must install the relevant sound insulation, noise elimination and vibration isolation equipment materials to conform with the requirements of law of Environmental Noise.

8. It is suggested to address an acoustical assessment to the surrounding environment in prior to commence of business. Effective measures should be taken to ensure the residents in the nearest residential buildings could not hear the musical sound from the loudspeakers, especially the music from outdoor performance, outdoor loudspeakers, and low frequency rhythm music.

9. The gates of such establishments should not be opened outward the buildings. If these gates have to be opened towards the street, appropriate entrance design should be adopted (for example, using two automatic doors with a space in between). Notices or posters should be displayed prominently at entrances and passageways to advise that customers should not shout, speak loudly or make irritative noise when they leave the places at night. When choosing sound insulation or noise elimination materials, the sound insulation materials should be able to diminish or isolate the sound of different frequencies and can effectively moderate sound frequency from loudspeaker. Moreover, appropriate information such as the data of sound insulation amplitude, the coefficient of sound absorption under different frequencies of the sound

insulation materials and maximum sound pressure output under different frequencies of the loudspeakers, etc should be provided in the submitted data.

10. Audio equipment should not be installed directly onto the architectural structure. It is advised to apply vibration isolation materials, and the specifications for such vibration isolation materials are: transfer ratio (T) of 0.01~0.05, vibration isolation efficiency (η) of 95~99%, frequency ratio (f/fo ─ the ratio between fixed frequency of vibration isolation system and driver frequency of vibration equipment) of 5.5~15.

11. In case the installation of glass window is involved, effective sound isolation effect glass (such as vacuum glass, double-paned glass, etc) should be considered in the design to ultimately reduce the noise transmission (especially low-frequency rhythm noise), or take other effective measures to ensure a better achievement and conform with the requirements of Decree.. This also helps to reduce the adverse effect caused by noise to the surrounding sound sensitive receptors (such as residential buildings, nursing homes and schools etc.).

9. The doors and windows should be kept closed during the operation to prevent the adverse effect of the noise generated by loudspeakers to the surrounding environment, especially for the sound sensitive receptors.

Water Pollution Control

1. Suitable control equipment should be installed to ensure the sewage discharged has to conform with the requirements of Law.

2. Regular inspection, repair and maintenance of the relevant pollution control equipment should be done to ensure the efficiency of treatment.

3. To avoid causing environmental pollution, sewage and waste oil should not be discharged into the storm drainage and surrounding environment to avoid environmental pollution. The waste oil should be collected properly and be treated effectively.

4. Under the feasible condition, it is advised to install appropriate water saving facilities such as water-saving taps, water-saving defrosting equipment and water saving flushers etc. Water saving measures should be implemented that include the prevention of continuous running tap while cleaning food. It is suggested to recycle the used water, such as the water which had been used for cleaning fruits and vegetables, the water from defrosting, etc so as to save water and reduce the operation costs.

14.7 Review Question

1. Write about the Solid and liquid waste?
2. What is the different in sullage and sewage?
3. Write a short note on disposal of solid waste?
4. Write a short note on Sewage treatment?
5. Write a short note on Pollution related to hotel industry?

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UNIT 15
AUDIO VISUAL EQUIPMENT

Summary

15.0 Objective

- Student know about the Various audio visual equipment used in hotel
- Student know about the Care and cleaning of overhead projector slide projector
- Student know about the LCD and power point presentation units
- Student know about the Maintenance of computers: Care and cleaning of PC,CPU, Modem, UPS, Printer
- Student know about the Laptops, Sensors – Various sensors used in different locations of a hotel –type, uses and cost effectiveness

15.1 Introduction

The term "audio-visual aids" is commonly misapplied. The aids themselves must be something either audible or visual, or both. The common types of audible aids are the spoken word, recognizable sound effects, and music. The most frequently used visual aids are people, pictures, cartoons, graphics, maps, the printed word, and three-dimensional models. When we talk about a motion picture projector or a blackboard, we are talking about the means of presenting the aids, and not the aids themselves. Audio-visual materials can be divided into those which present the aids in their original form, and those which reproduce the original form.In the following paragraphs, we will briefly define the most common means of display which make sights and sounds useable in the speaker-audience situation outlined above.

Audiovisual (**AV**) means possessing both a sound and a visual component, such as slide-tape presenta films, television programs, church services and live theater productions. Business presentations are also often audiovisual. In a typical presentation, the presenter provides the audio by speaking, and supplements it with a series of images projected onto a screen, either from a slide projector, or from a computer connected to a projector using presentation software. Computer-based audiovisual equipment is often used in education, with many schools and universities installing projection equipment and using interactive whiteboard technology.

The proliferation of audiovisual communications technologies, including sound, video, lighting, display and projection systems, is evident in every sector of society: in business, education, government, the military, healthcare, retail environments, worship, sports and entertainment, hospitality, restaurants, and museums. The application of audiovisual systems is found in collaborative conferencing (which includes video-conferencing, audio-conferencing, web-conferencing and data-conferencing); presentation rooms, auditoria, and lecture halls; command and control centers; digital signage, and more. Concerts and corporate events are among the most obvious venues where audiovisual equipment is used in a staged environment. Providers of this type of service are known as rental and staging companies, although they may also be served by an in-house technology team (e.g., in a hotel or conference center).

15.2 Various audio visual equipment used in hotel

Animation. Movement may be given to different types of visual aids. The materials necessary to do so fall in this section, but since they are usually improvised they cannot be specifically defined. Examples are given later in this report.

Blackboard. Black, green or other colored slate or composition board, or a specially painted surface which will "take" erasable white or colored chalk.

Bulletin Board. Flat board of cork, composition or other wood or material to which visual aids may be attached with pins, tacks or staples.

Easel or A-frame. Any type of frame which will hold flat-surfaced visual aids of any given size; characterized by the artist's easel, which is similar in structure to the letter "A," with a third leg used as a brace.

Feltboard. Any stiff, flat board covered with wool, felt or flannel. A variety of visual aids, usually cutouts of objects or strips of cardboard lettered with key words, with sandpaper or other abrasive backing, will adhere to the board. The same effect can be achieved by backing the visual aids with two-sided cellophane or masking tape, and covering the board with a piece of acetate; or by using strips of Velcro.

Flash Cards. A series of stiff cards, usually small enough to be held in the hands, each of which is imprinted with one or more key words.

Flip Charts. A series of visual aids on flexible paper, fastened together at the top and mounted on a frame in such a manner that they can be flipped or folded back. The frame usually resembles a football goal post, with the charts fastened to the crosspiece.

Model or Mock-up. A three-dimensional dummy, usually made to a small scale, which may or may not have working parts. The finished model is a visual aid. We are concerned here with construction materials.

Pegboard. Composition or plywood board, or other similar material, which has holes drilled through it at regular intervals, usually 3/4". Different types of metal clips, fitting the holes, will hold visual aids such as small posters, books and models.

Pointer. Any long, thin strip of material, such as a stick, ruler, etc., which may be used to indicate parts of the visual aid being emphasized. One new model contains a battery-powered flash light, with a beam shaped like a small arrow. The pointer can be used to indicate a portion of a slide, projected in a darkened room, without having the pointer's shadow fall on the screen.

Original Audio Materials

As was mentioned earlier, audible aids generally include the spoken word, recognizable sound effects, and music. The materials thus include people, anything which will produce a desired sound effect, and musical instruments. Sound reproduction equipment, if sound is to be used, becomes a necessity in many cases.

It might be inconvenient, for example, to recreate the din of downtown traffic, in its original form, within a small meeting room. A little library research on theatrical sound effects may be helpful.

Visual Projection Equipment

All visual projection equipment, with the exception of mirrors, the earliest "magic lanterns" and viewing screens, requires electricity to power its lighting elements. There are five basic types of modern equipment.

Filmstrip Projector. Equipment which will advance and project a 35 mm. filmstrip, one frame at a time.

Motion Picture Projector. Equipment which will project a series of pictures on a strip of film in such rapid succession as to give the appearance of movement to objects.

Opaque Projector. Equipment which will project the image of any opaque material, either flat or three-dimensional, placed beneath its lens.

Overhead Projector. Equipment which will project the image contained on transparent slides up to 10" X 10". Each transparency must be positioned on the projector by hand. The word "overhead" is taken from the design of the equipment, which actually projects the image to a mirror held above the transparency, which in turn reflects it over the head of the speaker to the viewing surface.

Slide Projector. Equipment which will project the image contained on a small transparent slide, usually 35 mm. (2" x 2" when framed). Many of these projectors are equipped with magazines to hold a large number of slides, and operation can be either manual or automatic.

All visual reproduction equipment requires a viewing surface of some type. Screens are discussed in a later chapter, in reference to the capabilities and limitations of the different pieces of equipment.

Audio Reproduction Equipment

The types of sound reproduction equipment are fewer in number than those for visual projection. They are:

Phonograph. Equipment which will reproduce sounds recorded or transcribed in grooves in the surface of a hard, round, flat record.

Sound Motion Picture Projector. A film projector which also has equipment for reproducing sounds recorded along the edge of the film itself.

Tape Recorder. Equipment which will reproduce sounds recorded on a rolled tape. Most tape recorders can be used to place the sound on the tape, as well as reproduce it.

Modern Tape Recorder

In addition to being used as a separate piece of audio equipment, phonograph records are also used in conjunction with filmstrips. The result is known as a sound slidefilm, sound having been added to a group of slides put together to make a film. A sound signal, either audible or inaudible, placed at intervals on the record, advances the filmstrip. The synchronized equipment is known as a *Sound Slidefilm Projector*.

. . .and Other Useful Terms

In these few pages, we have already presumed an understanding of some terms with which the average planner may not be familiar. These, and other terms which are used later in the report, are defined briefly below.

Film. (Used in the text as processed movie film.) A long, narrow strip of cellulose nitrate, acetate or similar material containing a succession of small transparent photographs. Common sizes are 8 and 16 millimeter, referring to the width of the strip.

Filmstrip. Same as Film, but usually in 35 mm. A filmstrip is usually compiled from a number of individual pictures taken with a 35 mm. still camera.

Graphics. Diagrammatic representation of numbers, taking several common forms such as the bar chart, line graph, or pie diagram; or a charting, such as an organization chart, flow chart, etc. Pictures are sometimes used, particularly in bar and flow charts.

Montage. A composite picture made by combining different elements. These may include photographs, lettering, magazine covers, etc.

Opaque. Possessing a thickness or density which prevents light from passing through the object. Total opacity is not necessary for the use of the opaque projector.

Slidefilm. See Filmstrip. The term slidefilm is used only when sound is added.

Tape. (Used in the text in reference to tape recordings.) A narrow strip of acetate or other material, somewhat similar to film, on which sound may be electronically recorded or transcribed.

Transparent. Opposite of Opaque. That through which light can pass.

Transparency. A picture viewed by having light shine through it.

15.3 Care and Cleaning of Overhead Projector Slide Projector

An overhead projector works on the same principle as a 35mm slide projector, in which a focusing lens projects light from an illuminated slide onto a projection screen where a real image is formed. However some differences are necessitated by the much larger size of the transparencies used (generally the size of a printed page), and the requirement that the transparency be placed face up (and readable to the presenter). For the latter purpose, the projector includes a mirror just before or after the focusing lens to fold the optical system toward the horizontal. That mirror also accomplishes a reversal of the image in order that the image projected onto the screen corresponds to that of the slide as seen by the presenter looking down at it, rather than a mirror image thereof. Therefore the transparency is placed face up (toward the mirror and focusing lens), in contrast with a 35mm slide projector or film projector (which lack such a mirror) where the slide's image is non-reversed on the side *opposite* the focusing lens.

Condenser

Because the focusing lens (typically less than 10 cm [4 in] in diameter) is much smaller than the transparency, a crucial role is played by the optical condenser which illuminates the transparency. Since this requires a large optical lens (at least the size of the transparency) but may be of poor optical quality (since the sharpness of the image does not depend on it), aFresnel lens is employed. The Fresnel lens is located at (or is part of) the glass plate on which the transparency is placed, and serves to redirect most of the light hitting it into a converging cone toward the focusing lens. Without such a condenserat that point, most of the light would miss the focusing lens (or it would have to be very large and prohibitively expensive). Additionally, mirrors or other condensing elements below the Fresnel lens serve to increase the portion of the light bulb's output which reaches the Fresnel lens in the first place. In order to provide sufficient light on the screen, a high intensity bulb is used which must be fan cooled.

Focus adjustment

Overhead projectors normally include a manual focusing mechanism which raises and lowers the position of the focusing lens (including the folding mirror) in order to adjust the object distance (optical distance between the slide and the lens) to focus at the chosen image distance (distance to the projection screen) given the fixed focal length of the focusing lens. This permits a range of projection distances.

Increasing (or decreasing) the projection distance increases (or decreases) the focusing system's magnification in order to fit the projection screen in use (or sometimes just to accommodate the room setup). Increasing the projection distance also means that the same amount of light is spread over a larger screen, resulting in a dimmer image. With a change in the

projection distance, the focusing must be readjusted for a sharp image. However, the condensing optics (Fresnel lens) is optimized for one particular vertical position of the lens, corresponding to one projection distance. Therefore when it is focused for a greatly different projection distance, part of the light cone projected by the Fresnel lens towards the focusing lens misses that lens. This has the greatest effect towards the outer edges of the projected image, so that one typically sees either blue or brown fringing at the edge of the screen when the focus is towards an extreme. Using the projector near its recommended projection distance allows a focusing position where this is avoided and the intensity across the screen is approximately uniform.

Source of illumination

The lamp technology of an overhead projector is typically very simple compared to a modern LCD or DLP video projector. Most overheads use an extremely high-power halogen lamp that may consume up to 750 watts. A high-flow blower is required to keep the bulb from melting due to the heat generated, and this blower is often on a timer that keeps it running for a period after the light is extinguished.

Further, the intense heat accelerates failure of the high intensity lamp, often burning out in less than 100 hours, requiring replacement. In contrast, a modern LCD or DLP projector uses an arc lamp which has a higher luminous efficacy and lasts for thousands of hours. A drawback of that technology is the warm up time required for arc lamps.

Older overhead projectors used a tubular quartz bulb which was mounted above a bowl-shaped polished reflector. However because the lamp was suspended above and outside the reflector, a large amount of light was cast to the sides inside the projector body that was wasted, thus requiring a higher power lamp for sufficient screen illumination. More modern overhead projectors use an integrated lamp and conical reflector assembly, allowing the lamp to be located deep within the reflector and sending a greater portion of its light towards the Fresnel lens; this permits using a lower power lamp for the same screen illumination.

A useful innovation for overhead projectors with integrated lamps/reflectors is the quick-swap dual-lamp control, allowing two lamps to be installed in the projector in movable sockets. If one lamp fails during a presentation the presenter can merely move a lever to slide the spare into position and continue with the presentation, without needing to open the projection unit or waiting for the failed bulb to cool before replacing it.

A **slide projector** is an opto-mechanical device for showing photographic slides.

35 mm slide projectors, direct descendants of the larger-format magic lantern, first came into widespread use during the 1950s as a form of occasional home entertainment; family members and friends would gather to view slide shows, which typically consisted

of Kodachrome slides snapped during vacations and at family events. Slide projectors were also widely used in educational and other institutional settings.

Photographic film slides and projectors have mostly been replaced by image files on digital storage media shown on a projection screen by using a video projector or simply displayed on a large-screen video monitor.

A projector has four main elements:

- electric incandescent light bulb or other light source (usually fan-cooled)
- reflector and "condensing" lens to direct the light to the slide
- slide holder
- focusing lens

A flat piece of heat-absorbing glass is often placed in the light path between the condensing lens and the slide, to avoid damaging the latter. This glass transmits visible wavelengths but absorbs infrared. Light passes through the transparent slide and lens, and the resulting image is enlarged and projected onto a perpendicular flat screen so the audience can view its reflection. Alternatively, the image may be projected onto a translucent "rear projection" screen, often used for continuous automatic display for close viewing. This form of projection also avoids the audience interrupting the light stream by casting their shadows on the projection or by bumping into the projector.

It is increasingly difficult in some countries to locate photo processors who will process slide film. Several manufacturers have stopped production of slide projectors.

Cleaning of Projector

Step 1

Disconnect your slide projector from its power source and allow 20 minutes for its internal components to cool. Remove the lens cap.

Step 2

Compress a squeeze bulb and release the air by releasing your grip on its bulb. A squeeze bulb is a device that is often comprised of a rubber or other elasticized polymer that, when squeezed, takes air in its bulb, or diaphragm. Upon releasing the bulb, air is released in a gentle manner, which avoids damage to your lens and safely removes residual dust and debris. Alternatively, you can use a soft-bristled lens brush to remove dust from a lens. Use a gentle, non-abrasive motion when sweeping the dust from the lens.

Step 3

Remove the lens from the projector, if possible, by pressing the retaining lever that holds the projector in place. If you cannot remove the lens, manually extend the lens, using the lens' focus knob and repeat step 2 on the portion of the lens that is exposed after you have extended the lens. If you removed your lens, repeat step 2 on the backside of the lens.

Step 4
Wipe the lens with a microfiber cloth. If the microfiber cloth fails to remove all smudges, lightly moisten a second microfiber cloth with denatured alcohol.

Step 5
Wipe the smudges from the lens with the microfiber cloth you moistened with denatured alcohol. Starting in the center, wipe the lens in a gentle, circular motion, until you reach the outer edges of the lens. Repeat on the other side if you removed your lens. Wipe the lens with a dry microfiber cloth.

Step 6
Replace the lens cap. Keep your projector powered off and the lens cap on when not in use to prevent the lens from collecting dust or debris.

15.4 LCD and Power Point Presentation Units

In the early 1980s–1990s, overhead projectors were used as part of a classroom computer display/projection system. A liquid-crystal panel mounted in a plastic frame was placed on top of the overhead projector and connected to the video output of the computer, often splitting off the normal monitor output. A cooling fan in the frame of the LCD panel would blow cooling air across the LCD to prevent overheating that would fog the image.

The first of these LCD panels were monochrome-only, and could display NTSC video output such as from an Apple IIcomputer or VCR. In the late 1980s color models became available, capable of "thousands" of colors (16-bit color), for the color Macintosh and VGA PCs. The displays were never particularly fast to refresh or update, resulting in the smearing of fast-moving images, but it was acceptable when nothing else was available.

The Do-It-Yourself community has started using this idea to make low-cost home theater projectors. By removing the casing and backlight assembly of a common LCD monitor, one can use the exposed LCD screen in conjunction with the overhead projector to project the contents of the LCD screen to the wall at a much lower cost than with standard LCD projectors. Due to the mirroring of the image in the head of the overhead projector, the image on the wall is "re-flipped" to where it would be if one was looking at the LCD screen normally.

PowerPoint presentations consist of a number of individual pages or "slides". The "slide" analogy is a reference to the slide projector. A better analogy would be the "foils" (or

transparencies/plastic sheets) that are shown with an overhead projector, although they are in decline now. Slides may contain text, graphics, sound, movies, and other objects, which may be arranged freely. The presentation can be printed, displayed live on a computer, or navigated through at the command of the presenter. For larger audiences the computer display is often projected using a video projector. Slides can also form the basis of webcasts.

PowerPoint provides three types of movements:

1. Entrance, emphasis, and exit of elements on a slide itself are controlled by what PowerPoint calls Custom Animations.
2. Transitions, on the other hand, are movements between slides. These can be animated in a variety of ways.
3. Custom animation can be used to create small story boards by animating pictures to enter, exit or move.

PowerPoint provides numerous features that offer flexibility and the ability to create a professional presentation. One of the features provides the ability to create a presentation that includes music which plays throughout the entire presentation or sound effects for particular slides. In addition to the ability to add sound files, the presentation can be designed to run, like a movie, on its own. PowerPoint allows the user to record the slide show with narration and a laser pointer. The user may customize slide shows to show the slides in a different order than originally designed and to have slides appear multiple times. Microsoft also offers the ability to broadcast the presentation to specific users via a link and Windows live.

15.5 Maintenance of Computers: Care and cleaning of PC,CPU, Modem, UPS, Printer

Computer cleaning involves physically cleaning the interior and exterior of a computer, including the removal of dust and debris from cooling fans, power supplies, and other hardware components.This should be done after certain period of time (weekly/monthly).

A computer containing accumulated dust and debris may not run properly.

Dust

Dust and other cruft may accumulate as a result of air cooling. Any filters used to mitigate this need regular service and changes. If the cooling system is not filtered then regular computer cleaning may prevent short circuits and overheating.

Data

Backups

Important data stored on computers may be copied and archived securely so that, in the event of failure, the data and systems may be reconstructed. When major maintenance such as patching is performed, a backup is recommended as the first step in case the update fails and reversion is required.

Disk cleanup may be performed as regular maintenance to remove these. Files may become fragmented and so slow the performance of the computer. Disk defragmentation may be performed to combine these fragments and so improve performance.

Legal issues

In the United States of America, the Digital Millennium Copyright Act specifically exempts computer-maintenance activities, so copies of copyright files may be made in the course of maintenance provided that they are destroyed afterwards.

Software

Operating system

Operating-system files such as the Windows registry may require maintenance. A utility such as a registry cleaner may be used for this.

Software updates

Software packages and operating systems may require regular updates to correct software bugs and to address security weaknesses.

When dealing with computers, dust isn't just unattractive—it can potentially destroy parts of your computer. By cleaning your computer regularly, you can help to **keep it working properly** and **avoid expensive repairs**.

Cleaning the keyboard

A dirty keyboard doesn't look nice and can cause your **keyboard** to **not work** properly. Dust, food, liquid, and other particles can get stuck underneath the keys, which can prevent them from working properly. Check your owner's manual to see if the manufacturer has provided you with instructions for your specific keyboard. If so, follow them. If not, the following steps are **basic cleaning tips** that can help keep your keyboard clean.

1. **Unplug** the keyboard from the USB or PS/2 port. If the keyboard is plugged into the PS/2 port, you will need to shut down the computer before unplugging it.
2. Turn the keyboard **upside down**, and gently shake it to remove dirt and dust.

3. Use a can of **compressed air** to clean between the keys.
4. Moisten a **cotton cloth** or **paper towel** with rubbing alcohol, and use it to clean the tops of the keys. Do not pour alcohol or any other liquid directly onto the keys.
5. **Reconnect** the keyboard to the computer once it is dry. If you are connecting it to a PS/2 port, you will need to connect it **before** turning on the computer.

Dealing with liquids

If you **spill liquid** on the keyboard, quickly shut down the computer and disconnect the keyboard and turn it upside down to allow the liquid to drain.

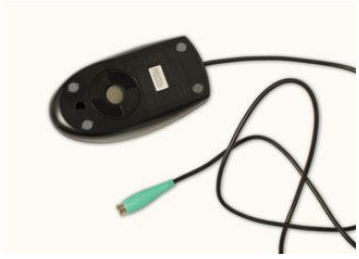
If the liquid is sticky, you will need to hold the keyboard on its side under running water to **rinse** the sticky liquid away. Then turn the keyboard upside down to drain for two days before reconnecting it. The keyboard may not be repairable at this point, but rinsing the sticky liquid off of it is the only chance for it to be usable again. The best way to avoid this situation is to keep drinks away from the computer area.

Cleaning the mouse

There are two main types of mice: **optical** and **mechanical**. Each is cleaned in basically the same way, although the mechanical mouse requires a bit more work.

- **Optical mice** require **no internal cleaning** because there aren't any rotating parts; however, they can get**sticky** over time as dust collects near the light emitter. This can cause erratic cursor movement or prevent the mouse from working properly.

- **Mechanical mice** are especially susceptible to **dust** and **particles** that can accumulate inside the mouse, which can make it difficult to track—or move—properly. If the mouse pointer does not move smoothly, the mouse may need to be cleaned.



Before you clean your mouse, check the owner's manual to see if the manufacturer has provided you with instructions for your specific mouse. If so, follow those instructions. If not, the following steps are **basic cleaning tips** that will help keep your mouse clean.

1. **Unplug** the mouse from the USB or PS/2 port. If the mouse is plugged into the PS/2 port, you will need to shut down the computer before unplugging it.
2. Moisten a **cotton cloth** with rubbing alcohol, and use it to clean the top and bottom of the mouse.
3. If you have a **mechanical mouse**, remove the **tracking ball** by turning the **ball-cover ring** counterclockwise. Then clean the tracking ball and the inside of the mouse with a **cotton cloth** moistened with rubbing alcohol.

4. Let **all of the parts dry** before reassembling and reconnecting the mouse. If you are connecting it to a PS/2 port, you will need to connect it **before** turning on the computer.

If you want to give the mouse a quick cleaning, place it on a **clean white sheet of paper** and move the mouse back and forth. Some of the dust and particles should rub off onto the paper.

Cleaning the monitor

Dirt, fingerprints, and dust can make your computer screen difficult to read; however, it's easy to **clean your screen**when needed. Although there are monitor-cleaning kits you can buy, they may damage your monitor if they are designed for a different type of monitor. For example, a monitor cleaner that is designed for **glass screens** may not work with some **nonglass LCD screens**. The safest method is simply to use a **soft clean cloth** moistened with**water**.

Do not use glass cleaner to clean a monitor. Many screens have anti-glare coatings that can be damaged by glass cleaner.

1. **Turn off** the computer.

2. **Unplug** the monitor from the power. If you are using a laptop, unplug the laptop.
3. Use a **soft clean cloth** moistened with **water** to wipe the screen clean.

Do not spray any liquids directly onto the screen. The liquid could leak into the monitor and damage the internal components.

15.6 Laptops, Sensors – Various sensors used in different locations of a hotel –type, uses and cost effectiveness

A **laptop** or a **notebook** is a portable personal computer with a clamshell form factor, suitable for mobile use. There was a difference between *laptops* and*notebooks* in the past, but nowadays it has gradually died away. Laptops are commonly used in a variety of settings, including at work, in education, and for personal multimedia.

A laptop combines the components and inputs of a desktop computer, including display, speakers, keyboard and pointing device (such as a touchpad or a trackpad) into a single device. Most modern-day laptops also have an integrated webcam and a microphone. A laptop can be powered either from a rechargeable battery, or bymains electricity via an AC adapter. Laptop is a diverse category of devices and other more specific terms, such as rugged notebook or convertible, refer to specialist types of laptops, which have been optimized for specific uses. Hardware specifications change significantly between different types, makes and models of laptops.

Portable computers, which later developed into modern laptops, were originally considered to be a small niche market, mostly for specialized field applications, such as the military, accountancy, for sales representatives etc. As portable computers developed and became more like modern laptops, becoming smaller, lighter, cheaper, and more powerful, they became very widely used for a variety of purposes.

Since the introduction of portable computers in late 70s, their form has seriously changed over decades, spawning a variety of visually and technologically differing subclasses.

Traditional laptop

AppleMacBook Pro, a laptop with a traditional design

The form of a traditional laptop computer is a clamshell, with a screen on one of its inner sides and a keyboard on the opposite. It can be easily folded t o conserve space while traveling. The screen and keyboard are inaccessible while closed. Devices of this form are commonly called a 'traditional laptop' or notebook, particularly if they have a screen of 13 to 17 inches diameter and run a full-featured operating system like Windows 8.1, OS X or Linux. Traditional laptops are the most common form of laptop, although Chromebooks, Convertible Laptops, Ultrabooks and Laplets (described below) are becoming more common, with similar performance being achieved in their more portable or affordable forms.

Subnotebook

Sony VAIO P series subnotebook

A *subnotebook* or an *ultraportable* is a laptop designed and marketed with an emphasis on portability (small size, low weight and often longer battery life). Subnotebooks are usually smaller and lighter than standard laptops, weighing between 0.8 and 2 kg (2 to 5 pounds), with a battery life, exceeding 10 hours. Since the introduction of *netbooks* and *ultrabooks*, the line between *subnotebooks* and either category has been blurry. Netbooks are in essence a more basic-featured and a cheap subcategory of subnotebooks, and while some ultrabooks have a screen size too large to qualify as subnotebooks, certain ultrabooks fit in a subnotebook category. One notable example of a subnotebook is Apple Macbook Air.

Netbook

A Samsung Chromebook netbook

Netbook was a form of a laptop as inexpensive, light-weight, energy-efficient device, especially suited for wireless communication and Internet access. Netbooks first became commercially available in around 2008 on the market, featuring a weight, a display size and a price combination of < 1 kg, < 9" and < U.S. $400respectively. The name *netbook* (with *net* short for *Internet*) is used as "the device excels in web-based computing performance".[19] To begin with, netbooks were mostly sold with light-weight variants of the Linux operating system, although later versions often have Windows XP or Windows 7 operating systems. All major Netbook producing companies stopped producing them by the end of 2012.

Convertible

A Lenovo X61 convertible laptop

Typical modern convertibles have a complex joint between the keyboard housing and the display permitting the display panel to swivel and then lie flat on the keyboard housing. Most convertibles feature a touchscreen display alongside the traditional touchpad, to work in a *tablet* mode. The convertibles fit both in *laptop* and*tablet* device categories, but usually considered laptops, due to increased size and weight over the mainstream tablets.

The single joint used to enable the rotate and swivel motion of the screen creates a physical point of weakness on the laptop. Some manufacturers have attempted to overcome these weak points by adopting innovative methods such as a sliding design in which the screen slides up from the slate-like position and locks into place to provide the laptop mode. Due to the design of convertibles, they have few other weaknesses over traditional laptops, although a smaller form is often desired to increase portability.

Laplet

Microsoft Surface Pro 3, a typical laplet

The most recent laptop device category is a *laplet*. It is a portmanteau of the words*laptop* and *tablet* and it is a crossover of these device types. Although being typically considered as a tablet (by such agencies as FAA and TSA), laplets share certain similarities to laptops, and may be considered as its alternative form. Laplets are often marketed as a *laptop replacement* tablets.

Its specification is most closely resembles one of an Ultra book, but laplets are made up of two distinct parts, offering a touchscreen display which can be separated from the keyboard. Laplets are often very thin (around 10 mm) and light devices with a long battery life. Compared to mainstream tablets, laplets can be distinguished from them as they feature an x86-architecture CPU (typically low- or ultra-low-voltage model), such as Intel Core i5, run a full-featured OS like Windows 8.1, and have a number of typical laptop I/O ports, such as USB and Mini DisplayPort.

Laplets are designed to be used not only as a media consumption device, but also as a valid desktop or laptop replacement due to their ability to run *desktop* applications, such as Adobe Photoshop, connect multiple peripheral devices, such as a mouse, keyboard and a number of external displays.

Desktop replacement

Alienware desktop replacement gaming laptop

A desktop-replacement laptop is a class of large device, which is not intended primarily for mobile use. They are bulkier and not as portable as other laptops, and are intended for use as compact and transportable alternatives to a desktop computer. Desktop replacements are larger and typically heavier, than other classes of laptops. They are capable of containing more powerful components and have a 15-inch or larger display.

Desktop replacement laptops' operation time on batteries is typically shorter than other laptops, in rare cases they have no battery at all. In the past, some laptops in this class used a limited range of desktop components to provide better performance for the same price at the expense of a battery life, although the practice has largely died out.

The names *Media Center Laptops* and *Gaming Laptops* are used to describe specialized notebook computers, often overlapping with the desktop replacement form factor.

Rugged notebook

A rugged laptop is designed to reliably operate in harsh usage conditions such as strong vibrations, extreme temperatures, and wet or dusty environments. Rugged laptops are usually designed from scratch, rather than adapted from regular consumer laptop models. Rugged laptops are bulkier, heavier, and much more expensive than regular laptops,[25] and thus are seldom seen in regular consumer use.

The design features found in rugged laptops include a rubber sheeting under keyboard keys, a sealed port and connector covers, a passive cooling, very bright displays, easily readable in daylight, cases and frames made of magnesium alloys that are much stronger, than plastic found in commercial laptops and solid-state storage devices or hard disc drives, that are shock mounted to withstand constant vibrations. Rugged laptops are commonly used by public safety services (police, fire and medical emergency), military, utilities, field service technicians, construction, mining and oil drilling personnel. Rugged laptops are usually sold to organizations, rather than individuals, and are rarely marketed via retail channels.

A **sensor** is a device that detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal; for example, a thermocouple converts temperature to an output voltage. But a mercury-in-glass thermometer is also a sensor; it converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube.

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances inmicromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the more traditional fields of temperature, pressure or flow measurement, for example into MARG sensors.

Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine and robotics.

A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C. Some sensors can also have an impact on what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors need to be designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches

15.7 Summary

Audiovisual (AV) means possessing both a sound and a visual component, such as slide-tape presenta films, television programs, church services and live theater productions. Business presentations are also often audiovisual. In a typical presentation, the presenter provides the audio by speaking, and supplements it with a series of images projected onto a screen, either from a slide projector, or from a computer connected to a projector using presentation software. Computer-based audiovisual equipment is often used in education, with many schools and universities installing projection equipment and using interactive whiteboard technology.

15.8 Review Question

1. Describe the Various audio visual equipment used in hotel?
2. How you Care and cleaning of overhead projector slide projector?
3. What is LCD and power point presentation units?
4. Describe the Maintenance of computers: Care and cleaning of PC,CPU, Modem, UPS, Printer?
5. Describe the Laptops, Sensors – Various sensors used in different locations of a hotel –type, uses and cost effectiveness?

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