Draft Study Material

CONSTRUCTION PAINTER AND DECORATOR

(Qualification Pack: Ref. Id. CON/QP0503)

Sector: Construction

(Grade XI)

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(a constituent unit of NCERT, under Ministry of Education, Government of India)
Shyamla Hills, Bhopal- 462 002, M.P., India
http://www.psscive.ac.in

Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives.

The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material.

Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material.

Deepak Paliwal
(Joint Director)
PSSCIVE, Bhopal

Date: 20 June 2024

STUDY MATERIAL DEVELOPMENT COMMITTEE

Members

Hemant Wadikar, Engineer and Lecturer, Building Maintenance, Swami Vivekanand Jr. College (HSC Vocational) Sindhi Society, Chembur, Mumbai

Neeraj Bhandari, Assistant Professor, PSSCIVE Bhopal.

Ms. Prachi Pateriya, PhD Scholar, Delhi Technology University

Member- Coordinator

Saurabh Prakash, *Professor*, Department of Engineering and Technology, PSS Central Institute of Vocational Education, Bhopal, Shyamla Hills, Madhya Pradesh, India

Table of Contents

Module 1 Introduction to Construction Painting

Module Overview

This module covers the career of Construction Painting and Decorating, outlining the role and responsibilities of professionals in this field. It covers essential personal attributes, such as attention to detail and creativity, required for success. The occupational map details career paths and opportunities. The module also introduces the basics of paint, including surface-oriented paints, and distinguishes between interior and exterior paints, providing foundational knowledge for aspiring painters and decorators.

Learning Outcomes

After completing this module, you will be able to:

- Understand the career path and opportunities in the relevant field.
- Understand the fundamental properties and types of paints.
- Recognize different paints based on surface requirements.
- Differentiate between paints used for interior and exterior applications.

Module Structure

1.1: "Construction Painting and Decorating" as a career
1.2: Role and Responsibilities of "Construction Painter and Decorator
1.3: Personal Attributes required for "Construction Painter and Decorator
1.4: Occupational map for "Construction Painter and Decorator"
1.5: Basics of Paint
1.6: Surface Oriented Paints
1.7: Interior and Exterior paints

Painting is the finishing term in a construction. Painting affects the aesthetic appearance of building from inside and outside. Therefore, Painting work as shown in Fig 1.1 should be carried out with great skill of workmanship.

Paints are used in building and other engineering works for covering the surfaces of wood, metal, masonry, plastered walls, slabs etc. Following are the main objectives of painting:

- To protect the surfaces from atmospheric influences and to preserve them from the decay, oxidation and corrosion.
- To improve the appearance of surfaces. The decorative effects can be created by painting. Also, the surface becomes hygienically good, colourful and attractive.
- To facilitate a smooth surface for easy cleaning.

Building alone are not only demands for the painting skills, many structures of iron and steel require paint to cover them. It provides a protective covering to them, without which they would crumble under the corrosive action of the weather.

The work of a construction painter is more than spreading paints on the surface. A real painting must protect as well as beautify the area on which it is applied. This requires accurate knowledge of tools and materials, along with the knowledge of the making of the surface to be covered.

Fig. 1.1: Painting work

1.1: "CONSTRUCTION PAINTING AND DECORATING" AS A CAREER

In general, "Construction Painting and Decorating" as an occupation has the most favorable working condition. Since it includes both outdoor and indoor jobs, the construction painters are not subjected to the wimps of weather. For them, there would be no loss of pay because of the rain. They could just move in-doo0r for work if the weather goes bad. Knowledge of the painting skills alone is responsible for making our homes attractive to our eyes.

Nowadays, homeowners are becoming more and more paint and colour conscious. They want up-to-date colour schemes, good materials, and superior workmanship. The professional painters who could advise the owners on how to decorate their home or business places are often required. They are given the full go-ahead to use their judgment to choose colour and material. They are given a chance to express their individuality with their skills. They can suggest new designs and colour combinations. This would make their work satisfaction. The pay opportunities in such works are also very comforting and perhaps "painting and decorating" as a profession may become their life's work.

1.2: ROLE AND RESPONSIBILITIES OF "CONSTRUCTION PAINTER AND DECORATOR

A construction painter and decorator play a major role in the finishing work of any construction work. They work on various surfaces and convert them into final products. They apply painting materials on the surfaces like masonry, metal and wood. In this process, they perform following roles:

1. Preparing of old and new surfaces of masonry, metal and wood for painting work.
2. Selecting proper materials, tools and personal protective equipment (PPE) for the work. In Unit 5, detail about the personal protective equipment is given.
3. Applying of paints, varnishes, polishes and other painting materials as per requirement, using proper tools and procedures.
4. Identify and rectify defects in painting work.
5. Performing housekeeping work.

1.3: PERSONAL ATTRIBUTES REQUIRED FOR "CONSTRUCTION PAINTER AND DECORATOR"

"Personal Attributes" means the distinguishing qualities, traits, or prominent aspects of a person. They are important as they describe the personality and orientation of the individual.

A person opting to be construction painter and decorator should have following personal attributes:

1. Should have some artistic abilities i.e., one should enjoy making things beautiful.
2. Should have good eye sight and good health.
3. Should be able to enjoy the fumes of paints and varnish, and be physically alert all the times.
4. Should be aware of personal hygiene.
5. Should be able to work in a well-organized and accurate manner
6. Should be able to work at height and take necessary safety precautions.
7. Should be hard working, reliable, courteous, and dedicated.
8. Should have good communication skills.
9.

1.4: OCCUPATIONAL MAP FOR "CONSTRUCTION PAINTER AND DECORATOR"

NSQF Level	Job Roles
NSQF Level – 10	Owners/CEOs/MDs of construction companies/firms
NSQF Level – 09	Higher management officials (Such as President, VPs, GM) of construction companies/firms
NSQF Level – 08	Managers/ Business Developer
NSQF Level – 07	Paint Engineer/ Interior Designer/Designer and Decorator

NSQF Level – 06	Supervisor Construction Painter
NSQF Level – 05	Chargeman/ Foreman Painting and Decorating
NSQF Level – 04	Construction Painter and Decorator
NSQF Level – 03	Assistant Construction Painter
NSQF Level – 02	Helper Construction Painter
NSQF Level – 01	General Helper – Construction Worker

1.5: BASICS OF PAINT

It is very important aspect that a painter should be aware about the different colours and paints which is required during the painting works.

1.5.1: Introduction of Paints

Paint is any pigmented substance applied over a surface, which dries to give a thin protective or decorative coating. The surface could be wooden, metallic or masonry. The paint can be applied in solid, gaseous and liquid states. Whereas, the varnishes are the transparent or nearly transparent solutions which are applied over the painted surfaces.

- In solid state, the paint is applied as a very fine powder and then baked at very high temperature. This makes the powder to melt down and adhere to the surface. This type of painting is common in industrial or automotive application.
- In gaseous state, the paint is applied as a gaseous suspension over the surface. The paint (in solid or liquid state) can be suspended in a gas to form gaseous suspension or aerosol and then it is sprayed over to the object. This is called as sprayed painting.
- In liquid state, the paint is directly applied to the surface of the object by using brushes, paint rollers, blades, scrapers, other instruments, or body parts such as fingers and thumbs.

A typical paint product is a homogenous mixture of pigments, extenders, resins or binders, additives and solvents.

- **Resins or Binders**: Resins are prepared by a chemical process called polymerisation. The resin helps to bind the pigment particles together and hence it is also called a binder. It is a major ingredient of any paint and is responsible for the film formation in paint.
- **Pigments**: Pigments are powder material insoluble in resin, water, or solvents and impart colour and opacity (hiding power) to the paint. They may be organic or inorganic. Combinations of different coloured pigments give a variety of other colours. In metallic pigments, aluminium and other metallic pigments are used to impart sparkling and metallic effect. (Fig 1.2)

Fig 1.2 (a) Colour pigment (b) White Pigment (c) Metallic pigments

- **Extenders**: Extenders are economical minerals added to increase the pigment content of the paint and contain the cost. They give filling properties, increase bulk volume and add certain desired properties to the paint. Calcium carbonate is a typical extender used in water-based decorative paints as shown in Fig 1.3.

Fig 1.3 Calcium carbonate powder extender

- **Additives**: Additives are used in small quantities for enhancing certain desired properties like ease of application, flow and levelling, drying, curing, UV resistance, colour stability etc. In general, additives upgrade the performance properties of paint. Examples – anti-settling agent, wetting agents, UV resistant etc.

- **Solvents**: These are liquids used to reduce the viscosity of paint so that it can be easily applied on the surface. Solvents can be classified as aliphatic (mineral turpentine), aromatic (xylene, toluene etc), alcohols, ketones and esters. For water-based products, water is the solvent.

1.5.2 Characteristics of an ideal paint

Following are the characteristics of an ideal paint:

1. The paint should cover maximum area of the surface should be covered by minimum quantity of paint i.e. it should possess good spreading power.
2. It provides a smooth surface for easy cleaning.
3. It should be economical and fairly cheap.
4. The paint should not affect the health of the workers during its application.
5. It should possess attractive and pleasing appearance.
6. The paint should be such that it dries in reasonable time.

Do you know?

As we have already seen, resin is a major ingredient in paint and is responsible for making the paint into a film. There are different types of resins that can be used to make paint. It is important to understand the characteristics of each resin type as they determine the properties of the final paint.

Type of Resin	Characteristics
Alkyds	Alkyds are economical resins, mainly used in architectural paints. Enamel or oil paint is based on this resin. Paint film formation takes place at room temperature.
Polyester	These resins are superior to alkyd resins in performance. They are mainly used in automobiles.
Acrylics	These resins have good durability against ultraviolet rays. They are mainly used in automobiles.
Epoxies	Epoxies have good corrosion resistance, chemical resistance and water resistance properties. They are used mainly in protective coatings.

1.5.3 Primary and Secondary Colours

Colour is the appearance of things that is caused by the different qualities of light that they reflect or emit. It is necessary to have light in order to see colour. Some colours bounce off an object while others are absorbed by it when light shines on it. Our eyes only see the colours that are reflected or bounced off.

Colour is mainly divided into three categories:

1. **Primary Colours:** The colours which cannot be produced by mixing of other colours are called as Primary colours. There are three primary colours: red, blue and yellow as shown in Fig. 1.4.

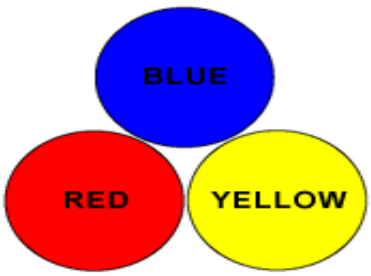

Fig.1.4: Primary colour

2. **Secondary Colours:** The colours which are obtained by combining of any two of the primary colours in equal proportions are called secondary colours. There are three secondary colours: purple/ violet, green and orange as shown in Fig. 1.5. They are obtained from following combinations:

- "Red" combines with "Blue" to give "Purple/ violet" colour.
- "Blue" combines with "Yellow" to give "Green" colour.
- "Red" combines with "Yellow" to give "Orange" colour.

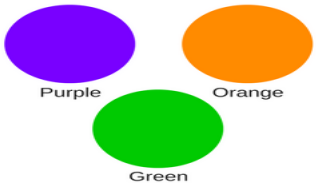

Fig.1.5: Secondary colour

Do you know?

Intermediary colours: When the primaries are not mixed in equal amounts, intermediary colours are formed, such as yellow-green (chartreuse), green-yellow (apple green), etc. as shown in fig. 1.6.

Fig 1.6 Intermediate colors

3. **Tertiary Colours:** A third set of colours which are created when amount of a primary equal and a secondary colour are mixed, is termed as tertiary colours. There are six tertiary colours: red-orange, yellow-orange, yellow-green, blue-green, blue-violet, red-violet as shown in Fig. 1.7.

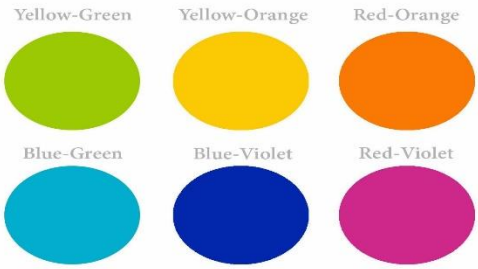

Fig.1.7: Tertiary colours

1.6: SURFACE ORIENTED PAINTS

There are certain types of paints that has been used for specific surfaces, some of them are mentioned below:

1.6.1 Varnish

The term varnish is used to indicate the solution of resinous (any natural or synthetic organic compound) substances prepared in either oil, turpentine or oil that dries to a hard-transparent film.

It mainly provides protective coating for wooden surfaces, paintings, and various decorative objects. Varnish protects and enhances the appearance of wooden floors, interior wood panelling and trim, and furniture. This will be covered in more detail in Unit 4.

1.6.2 Distempers

It is made with a combination of pigment, chalk, lime, water and animal glue-like resin. It is one of the oldest types of paint. It is also called cement paint.

The main object of applying distemper to plastered surface is to create a smooth surface.

Following are some properties of distemper:

1. The film of the distemper shrinks, hence it leads to cracking and flaking if surface to receive distemper is weak.
2. They are less durable than oil paints.
3. The film of the distemper is porous and it allows the water vapour to pass through it. Hence it permits new walls to dry out without damaging the distemper film.
4. The distemper coating is usually thick.
5. These are found to be more brittle than other types of paints.

1.6.3 Whitewashing

The fresh lime (hydroxides of calcium) at the site of work and mixed thoroughly with water in a tub. The surface to be whitewashed should be clean before the work has started.

The lime is toxic for germs. It reflects light and thus it increases the brightness of the surface, therefore whitewashing is extensively used for interior walls surfaces and ceilings of houses.

The overall procedure of whitewashing is explained in detail in Unit 3 (Precisely 3.10).

1.8 INTERIOR AND EXTERIOR PAINTS

Different paints come with different properties, as they are manufactured for different purposes. The paint manufactured for interior and exterior surfaces are different as the environment subjected to them differs prominently. Both interior and exterior paints

have similar solvents and pigments, but exterior paints may contain more pigment. The major difference between these paints is in additives and resins.

1.8.1 Characteristics of Interior Paints

1. Purposes of the interior paint of a building are aesthetics, decoration and add properties of easy maintenance, wash ability and dampness prevention.
2. It is designed to withstand abrasion and to be more delicate than exterior paint as it occupies the habitable area.
3. It is formulated to resist physical damage and staining.
4. The resin used for it can be firmer as it does not deal with weather and temperature differences like exterior paint.
5. It does not fade easily as it is not subjected to extreme temperature conditions.
6. It should be staining resistance to hide the marks of brushes and rollers.
7. It should get cured even without direct exposure to sunlight.
8. It does not require additive like pesticides and fungicides.
9. It should have a low or zero VOC (Volatile organic compounds). This helps in preserving the air quality of the interior space and reduces health risk.

1.8.2 Characteristics of Exterior Paints

1. Purposes of the exterior paint are protection against harsh weather conditions, UV radiation, fungal growth, and to add colour to the building for aesthetic appearance.
2. The resins used for it can be softer so that it can withstand temperature changes and ill effect of moisture exposure.
3. It is designed to be fade resistant as it faces very high temperatures.
4. It should be water resistant. Hence it is made waterproof.
5. It contains many additives like pesticides and fungicides.
6. It releases many VOC as it cures, making it unsafe for indoor use.

Do you know?

Decorative paints account for 75% of the Indian paint market. Texture painting as shown in fig 1.9 gives an extraordinary look at the wall. It is very popular type of paint to cover dry wall. The paint has heavy consistency and consists of grains of sand and/or gypsum which is bound by water-thinned binder. Use of texture paint creates a roughly patterned effect on the wall.

Fig 1.9 Texture painting

Activities

Activity 01: Make a list of Interior and Exterior paint.

Material required:

1. Notebook
2. Pen

Procedure:

1. First, take permission to the hardware shop owner.
2. Second, visit the hardware shop.
3. Identify the interior and exterior paint available in the shop.
4. List down the name of interior and exterior paint available in the shop.

Activity 02: Make a list of basic colour used in painting.

Material required:

1. Notebook
2. Pen

Procedure:

1. First, take permission to the hardware shop owner.
2. Second, visit the hardware shop.
3. Identify the basic colour used in painting.
4. List down the name of basic colour used in painting.

Check Your Progress

A. Answer the following

1. What are the personal attributes required for a construction painter?
2. Define the term paint.
3. Explain the basic colours used in painting?
4. Write down the characteristic of interior and exterior paint?
5. Define the following terms: 1. Whitewashing 2. Varnish 3. Distemper
6. What are the basic five ingredients of a paint?

B. Fill in the blank

1. ..... attributes mean the distinguishing qualities, traits, or prominent aspects of a person.
2. ..... paints contain low or almost zero volatile organic compounds.
3. The function of ..... is to make the paint thin so that it can be easily applied on the surface.
4. There are three primary colours Red, ... and .....
5. The substance that helps in drying process is known as .....

C. Match the following

Column A	Column B
1. The colours which cannot be produced by mixing of other colours.	A. Secondary colours
2. The colours which are obtained by combining of any two of the primary colours.	B. Exterior paint
3. It is formulated to resist physical damage and staining.	C. Whitewashing
4. It is designed to be fade resistant as it faces very high temperatures.	D. Interior paint
5. It is made up of slaking of fresh lime	E. Primary colours

Module 2 Painting Tools and Maintenance

Module Overview
This module covers different types of painting tools, and highlighting their specific applications and uses. It also emphasizes the importance of proper cleaning and maintenance of these tools to extend their lifespan, maintain the quality of work, and prevent contamination in painting projects. Proper care ensures that tools remain in good condition, contributing to better results and more efficient use of resources.

Learning Outcomes
After completing this module, you will be able to: • Identify various painting tools. • Describe the uses of various painting tools. • Explain the significance of maintaining painting tools.

Module Structure
2.1: Different Types of Painting Tools 2.2: Importance of cleaning and maintenance of painting tools

2.1: Different Types of Painting Tools

So far, we have studied the importance and role of painting and decorating work, where the painter and decorator are responsible for aesthetics of any building works. We will now look at the painting tools that help a painter to perform the painting activities effectively. Like any other sector, a thorough knowledge and working of tools and material used in painting are essential for a painter to carry out the tasks.

Generally, there are two types of tools used for painting – Hand tools and Power tools. As the name suggests, Tools which require manual labour to use are known as Hand tools whereas the tools that require power to operate are known as Power tools.

1. **Painting Tray:** A tray as shown in Fig. 2.1. The tray is used to pour the paint if roller is to be used for painting. Wide painting tray is preferred as it will easily accommodate roller. It's important that right amount of paint must be present in the tray which will make it possible to have the perfect amount of paint on your roller. If present in excess quantity, it will have a lot of drips, and if paint is present in too little amount, it will be difficult to get even coverage on your walls.

Fig 2.1: Painting Tray

2. **Paint Tray Liner:** The use of paint tray liner as shown in Fig 2.2 removes the necessity to clean out the paint tray in between new colour or at the end of painting session, hence increases the efficiency in the completion of panting projects. It can be easily withheld in a painting tray confirming to its shape. Once the painting is finished. Painting tray liner can be thrown away as these are designed for no-mess and no-cleanup.

Fig 2.2 Paint Tray Liner

3. **Brush:** A brush is a hand tool that will make painting job very quick and easy. Lower-quality brushes will tend to lose their bristles in the paint, which can be unsightly and cause texture in the walls which are not at all required. Choosing a good quality brush of right size will make the painting job easier and faster. (Fig. 2.3)

Fig 2.3: Brush

4. **Tape:** Painting tape is used to prevent the areas that should not be painted. These tapes can be removed very quickly and easily once the painting work is finished. It generally provides a sharp edge in painting that block off certain so that it doesn't get accidentally painted. (Fig. 2.4)

Fig 2.4: Tape

5. **Drop cloth:** A drop cloth is a large sheet for covering the furniture and floor of the room where painting work is to be done. The spilling of paint can ruin the floor and furniture of the room. Thinner plastic drop can be used if only once it is to be used while fabric of thicker quality is preferred if it is to be used multiple times. (Fig 2.5)

Fig 2.5: Drop cloth

6. **Corner Edges:** Painting around the corners of your windows, doors, and cabinets can sometimes be tricky, even if painter's tape is used. For that reason, using corner edges is a good idea. Corner edges as shown in Fig. 2.6 are the plastic tools that will fit around the corners of your cupboards or moulding that avoid to accidentally paint and help to keep the edges neat and clean.

Fig 2.6: Corner Edges

7. **Sprayer:** Paint sprayer proves to be convenient for applying paint in less time than with a roller to brush. This can be a hand or power tool too. It applies a fine mist of paint through a spray nozzle. Overspray in any area is to be taken care off. (Fig. 2.7)

Fig 2.7: Sprayer

8. **Edger:** As the name suggests, Edger are the tools used for wall painting such as juncture between two walls, around the door or window trim etc. These tools eliminate the need for taping along the surfaces and thus allow to move forward with the painting job quickly. (Fig 2.8)

Fig 2.8: Edger

9. **Extension Pole:** These are the important part of painter's toolbox. It allows to reach such areas which are unreachable and also reduce the amount of ladder work needed as shown in Fig 2.9. These poles generally have threaded end that allows to screw on the paint roller. Once properly used, will greatly speed up the painting process and ensure no spots will be missed near the higher elevation points such as ceiling.

Fig 2.9: Extension Pole

10. **Painter's Tool:** The painters tool as shown in Fig 2.10 can be used for multiple functions. Some of them are as follows –

1. For cleaning paint rollers
2. To open cans
3. The blade of this tool is very thin and can be efficiently used for scraping.
4. Used for pulling small nails

Thus, it is a multi-faceted device that's ensure the work to be done speedily and easily.

Fig 2.10: Painter's Tool

11. **Paint Remover:** This is a chemical product that is used to remove the old paint, coating and finishes. It is important the paint remover must be environmentally friendly and odour free so that there is no risk of breathing the dangerous fumes.

12. **Paint Bucket:** A paint bucket as shown in Fig. 2.11 are the container that hold the paint while its being applied. It should be as small to be carried easily, but large enough to hold ample paint for one's needs.

Fig 2.11: Paint Bucket

13. **Paint Guide:** A paint guide as shown in Fig. 2.12 makes painting up against the carpet, other floors, and cabinets easy and decreases the likelihood to be accidentally painted on areas that shouldn't be painted. Using these guides as shown in Fig. 2.13 become especially important when painting is to be done on floorboard (a long plank making of wooden floor in building) because any paint on the carpet can cause the fibres to stick to

the floorboard itself. Longer paint guides will allow to complete a painting in bigger areas in shorter amount of time.

Fig 2.12: Paint Guide

Fig 2.13 Using paint guide on wall

14. **Lock Jaw Tool Holder:** While extension poles are ideal for rolling higher up on the wall without any problem, most poles do not have the ability to hold a paintbrush as well as a roller. In this case, Lock jaw tool holder is attached to the threaded end of the pole that's allows to hold brushes easily as shown in Fig. 2.14. This tool can be adjusted in 15-degree increments, that enable the brush to be in the perfect position for painting on the wall or the ceiling Additionally, this tool can be used with an extension pole to hold a flashlight and scraper too.

Fig 2.14: Lock Jaw Tool Holder

15. **Brush Type:** There are several types of paint brush are as:

a) **Stencil Brush:** Stencil brushes as shown in Fig. 2.15 are round and chubby that features such bristles which are carefully trimmed to form a blunt end. These specialty brushes are used to better apply paint, as they help prevent colours from seeping beneath. While these brushes are not useful for painting large areas, they make design work fast and easy.

Fig 2.15: Stencil Brush

b) Angle Sash: An angle sash brush as shown in Fig. 2.16 has slanted bristles and will hold a fair amount of paint. The cut at the slant makes it easier to paint clean lines.

Fig 2.16: Angle Sash

c) Flat Sash: This type of brush has bristles that are completely straight all the way across the brush and is ideal for painting on flat surfaces. While it is not easy to cut in with this type of brush, but can easily fill in areas on the wall using a flat sash brush. (Fig 2.17)

Fig 2.17: Flat Sash

d) Wall brush: Thicker brushes that hold more paint are called wall brushes as shown in Fig. 2.18. They are ideal for painting large surfaces such as a wall when you do not want to use a roller. Due to their size, they should not be used for fine detail work, as they simply hold too much paint and are too bulky to try to use in a smaller space.

Fig 2.18: Wall brush

e) Trim: Trim brushes as shown in Fig 2.19 are the flat brushes are ideal for quickly covering larger surfaces, as long as they are flat. They are generally used for painting exterior siding.

Fig 2.19: Trim brush

f) Chip brush: Chip brushes are generally fairly small and are perfect for painting in awkward or enclosed spaces. These are best suited for fine detail work and will leave a professional and clean appearance if used carefully. (Fig 2.20)

Fig 2.20: Chip brush

g) Bristle Types

1. **Natural:** Made with animal hairs, these brushes are ideal for applying paint that has an oil base. Due to the splitting of the tips of the bristles, these brushes will hold more paint and release it smoothly and evenly onto your wall for a nice finish. (Fig 2.21)

Fig 2.21: Bristle brush (Natural)

2. **Blended Nylon/Polyester brush:** These brushes are very easy to clean and are great for use with latex paint. When cared properly, they will last for many years. Nylon is very durable, and polyester holds its shape well, making for a durable and reliable brush. (Fig 2.22)

Fig 2.22: Blended Nylon/Polyester brush

3. **Polyester brush:** Polyester brushes are recommended for use with latex and oil base paints, and varnish. Polyester brushes keep their shape and stiffness in any type of paint and will deliver paint smoothly and evenly. The polyester brush is a good all- around brush and will hold up quite well in paint remover too.

4. **Embossed type brush:** To quickly add a lot of interest and design to the wall without having to use a stencil one should use an embossed roller. These rollers have a design cut into them as shown in Fig 2.23 and have a firmer surface than rollers that are generally used to cover large areas with paint. By carefully applying a thin amount of paint to the roller, and then rolling it evenly and smoothly over the wall, one can create texture and add visual interest to the walls quickly and easily.

Fig 2.23: Embossed brush

h) **Ergonomic Paint Brush:** Painting for long hours at a time can really take its toll on one's body, especially holding a paintbrush for the majority of the time can generate hand cramps. An ergonomic paintbrush can keep one hand feeling at its best and helps the painters to hold the paint brush for long with ease as shown in Fig 2.24.

Fig 2.24: Ergonomic paint brush

16. **Painter Kit:** A painter kit consists of all the tools required for a painting job. These kits generally come with a different type of brushes, making it ideal for beginners as they will have the right brushes for trimming out and for painting larger areas, as well. (Fig 2.25)

Fig 2.25: Painter Kit

17. **Magnetic Paint Cup:** Some paint cups come with a magnetic strip along the inside of them that will make it easy to store the paintbrush inside the cup without it falling down into the paint. When one chooses a paint cup that has this feature, then there are no worries about the brush getting too much paint on it or falling out of the cup. (Fig 2.26)

Fig 2.26: Magnetic Paint Cup

18. **Adjustable Angle:** A paint brush roller extension that has an adjustable angle as shown in Fig 2.27 will allow the brush to turn to the perfect angle for painting the wall. This will eliminate the need to turn one's body into an awkward angle or contort the arms to get the brush to line up perfectly with the wall when painting.

Fig 2.27: Adjustable Angle

19. **Sandpaper:** To remove the imperfections on walls, ceilings, furniture and any surface, sandpaper is used. It is also used to roughen surfaces too glossy for paint or filling compound to adhere easily. (Fig. 2.28)

Sandpaper grit is sized by a gauge number, with lower numbers signifying larger, coarser grits.

For example, 40-grit sandpaper is a very coarse, rough sandpaper, while the 1,000-grit paper is extremely fine with very small abrasive particles.

Coarser, or lower-number grit, sandpaper removes wood and other materials faster and with less effort than finer sandpaper. It does this by cutting the fibers on the material's surface whereas, with too-fine sandpaper can actually burnish or create a shine to the surface.

Fig 2.28: Adjustable Angle

Do you know?

Electric sanders have an important added benefit of dust extract on as part of the sanding system. Sanders are basically power tools with abrasives attached and are powered either by electricity or compressed air. The key components of an electric sander are:

- **Sanding disc**: Sanding discs are abrasives on a paper / cloth or other synthetic material and come in different sizes (diameters) and also in different sizes of grit (grains sizes). The discs have holes in them to collect the dust produced by the sanding process
- **Electric motor**: The electric sander has a 1.2 KV electric motor to power the disc and the dust collector.
- **Dust collector**: Like a vacuum cleaner, the electric sander sucks all the dust generated by the sanding through the holes in the disc into a dust bag.
- **Handle**: Handles come in different shapes to suit customer preferences. The most common are the palm grip and long handle.
- **Trigger switch**: The trigger switch is to switch on or off the rotating disc.

Let us understand the sand paper grit with an example - In 60-grit sandpaper, the abrasive particles (materials that can be used for cleaning, polishing and grinding) used in paper were sieved through a screen that has 60holes per square inch.

2.2: Importance of cleaning and maintenance of painting tools

No matter where so ever the painting work is done, the quality of the painting tools is crucial to the quality of the finished product. All the tools used in painting requires proper cleaning and maintenance as it will increase the quality life of the tool.

A clean and tidy paint brush can last can lasts for many more painting jobs. If proper maintenance is not given to any of the painting tools, it will increase the cost of purchasing a new one and also delay the painting job.

2.2.1 Techniques of cleaning & Maintenance procedure of painting tools:

The important painting tools that mainly need to be taken care after every painting job are: Brush, roller, painting tray and bucket.

- **Reuse the rollers with these 3 simple steps:**
  a) Scrape the roller after use but do not let it dry out.
  b) Create an airtight cover with plastic wrap or a plastic bag - keeping it moist is key.
  c) Store the wrapped roller in a refrigerator to keep it fresh for a longer period of time.

- **Cleaning of Paintbrush:**

a) Cleaning oil-based paints: To select the correct solvent, read the manufacturer's instructions carefully. These will advise you on whether you should use mineral spirits or paint thinner for paint and varnish, denatured alcohol for shellac, etc.

Pour the solvent into a container and dip the brushes in. Work the solvent into the bristle brushes several times and shake the excess off. Continue this process with a clean container and new solvent.

b) Cleaning water-based paints: Water based products are easier to clean.
Place a simple solution of warm water and mild soap suds in a clean container and dip brushes into mixture. Work soap into brush bristles to ensure that all paint is removed. To finish, give the brushes a clear water rinse. This process may need to be repeated.

Once you have cleaned the brush of as much paint as possible, wash it in warm, soapy water, rinse and squeeze it back into shape. Wrap bristles in paper and secure with a rubber band.

c) Cleaning a paint roller: A wet and spin roller washer can be used to clean it easily. Just put the roller into the container, connect the hose to a tap and within a few minutes the roller will be clean and ready to use again. I

If you don't have a washer, simply remove the roller sleeve cover as soon as you have finished painting and clean immediately. Do not let the paint dry on the roller.

Activities

Activity 01: Make a list of painting tools.

Material required:

1. Notebook

2. Pen

Procedure:

1. First, take permission to the hardware shop owner.
2. Second, visit the hardware shop.
3. Identify the painting tools used during painting work.
4. List down the name of painting tools used during painting work.

Check Your Progress

A. Answer the following

1. Write down the features and use of following tools:
   a. Painter's tool
   b. Lock Jaw Tool Holder
   c. Sprayer
   d. Drop cloth
2. How to reuse rollers used in painting?
3. How to clean oil-based paint brushes?
4. Enlist the tools included in the painter's kit.

B. Fill in the blank

1. An …….. brush has slanted bristles and will hold a fair amount of paint.
2. A slanted brush, the thin angle sash brush will easily create a …… and …… line.
3. The plastic tools that will fit around the corners ensuring edges to be painted neat and clean are known as……
4. …….. brushes are generally fairly small and are perfect for painting in awkward or enclosed spaces

C. Match the following

Column A	Column B
1. **Paint bucket**	A. 

2. **Sprayer**	B. 
3. **Tape**	C. 
4. **Edger**	D. 
5. **Adjustable angle**	E. 

Module 3	Painting Procedure

Module Overview
This module outlines the essential steps in painting, from site preparation to the final application. It begins with preparing the site, which includes cleaning the area, protecting surfaces, and ensuring safety. Next, it covers surface evaluation, identifying defects, and preparing the surface for painting. Key materials for surface preparation

are discussed, followed by priming and applying undercoats. The module concludes with detailed procedures for paint application, whitewashing, and essential precautions to ensure a quality finish.

Learning Outcomes

After completing this module, you will be able to:

- Understand the importance of site preparation and implement effective safety measures.
- Identify common surface and painting defects and address them appropriately.
- Identify appropriate for surface preparation and painting.
- Understand the procedure for whitewashing surfaces.
-

Module Structure

3.1: Site Preparation
3.2: Steps involved in Site Preparation
3.3: Surface Evaluation of Masonry surfaces
3.4: Defects in Surface and Paintings:
3.5: Surface Preparation
3.6: Materials used for Surface Preparation
3.7: Priming
3.8: Undercoats in painting
3.9: Procedure of Application of paint
3.10: Procedure of Whitewashing the surface
3.11: Precautions during Application of paint

3.1 SITE PREPARATION

In previous units you have learned about the basics of the paint and the tools used in painting. Now next step is How to paint a surface? Painting must be done in such a way that the paint must be evenly distributed, free from any defects and good in aesthetic appearance too. In this unit you will learn about the proper procedures to be followed before, during and after the painting for optimum results.

This step is very important and especially when the painting is done indoors like in a house which has different objects like furniture, floor, electronic items etc. which needs to covered or shifted so that painting job doesn't spoil them. Plastic sheets, newspapers,

cartons, clothes etc. can be used to cover the items. Painter's Tape is a better choice to properly fix the covering items in place.

A Painter should ensure properly that this step is taken care of as it may result in ruining expensive and decorative households or other in which contractor is liable to pay the damage and creates a bad impression on the Client which can affect future contracts. It is always advised to shift the objects which can be moved as it leaves least chances of any damage. The inner view of a painting room of a house is shown in Fig. 3.1.

In case of exterior painting, no such preparation is required except determining the condition of the existing paint on the surface.

Fig. 3.1 Inner view of a painting room of a house

3.2 STEPS INVOLVED IN SITE PREPARATION

3.2.1 Interior Paint Preparation

Step 1: Washing the walls if stored dirt is a problem. Any home detergent will work. Use chlorine-based bleach on mildew (Certain type of fungus caused by lack of ventilation and humid conditions).

Step 2: Use a scrapper blade to clear all open paint and sand down the rough ridges. Excavate any damaged particle of an inch on both sides to form a 'V' shape. Improves the contact area for your patching material to attach.

Step 3: Apply spackle (Compound of Calcium sulfate dihydrate used to fill cracks) or putty to gaps and voids. Two light patch coats are always more reasonable than one thick coat. Spackle that's also expansive overlooks to shrink and break as it dries.

Step 4: Use latex caulk (used to seal gaps between the building materials) to fill joints around door frames, window containers and base boards. The wide and deep joint may need more than one application. Use a wet rag to brush off any excess caulk.

Step 5: Sand down all polished surfaces or treat them with the liquid sand paper. It provides a rough surface for good bonding for the next coat.

3.2.2 Exterior Paint Preparation

Step 1: Before starting any other work check for leaks and any moisture getting into the substrate. Repair any roof leaks, gutters, windows and leaky plumbing. Damp basements and other too moist interior rooms are different sources of moisture in the substrate.

Step 2: All outer surfaces will need washed to remove decay, dirt and extreme chalking. Consider using a power washer (shower to produce a high-pressure spray) if more than 500 square feet of surface to clean.

Step 3: Any surface that has the mould (a type of fungus on walls) as shown in Fig 3.2 must be treated entirely before painting. Wash the mildewed surface with one quart of home bleach mixture in a gallon of water.

Fig 3.2 Moulds on wall

Step 4: Chalking is a loosely bound powder that forms on the surface of the paint. Chalking happens when the paint binder is destroyed by sun and moisture. Scrape, sand and wash off all chalking before primer application.

Step 5: Rub off loose paint on plaster and repair all cracks and holes. Fill 0gaps around windows, door casings, or where two materials meet at the foundation line of where wood meets masonary.

3.3 SURFACE EVALUATION OF MASONARY SURFACES:

A long-lasting painted surface is a result of proper selection of materials and tools for the job. A painter is required to evaluate the surface to be painted (both indoors and outdoors). A painter should visually evaluate:

- Type of surface (newly prepared or old, masonry, metal or wood etc.)
- Check for any defects in the surface and apply appropriate method to ensure smooth painting.

- Apply appropriate measures to the respective surface for better and reliable result.

A proper surface evaluation will help make and maintain a proper schedule of work. It will also aid in finalizing the contract.

3.3.1 Surface evaluation of Newly plastered finished surface

Following things must be evaluated before painting the newly plastered surface -

1. A plastered surface should be painted only after it has thoroughly dried, otherwise the paint would get spoil.
2. Cracks or holes, if any, should be cured off and the surface sand papered on its drying.
3. Plastered surface must be free from any undulations or cracks.
4. The plaster on the wall must be done evenly.

3.3.2 Surface evaluation of old painted masonry surface

Following things must be evaluated before painting the newly plastered surface –

1. The surface should be even throughout. Remove any flaked paint from the wall.
2. The surface should be dry.
3. The surface must be free from cracks and fissures.

3.4 DEFECTS IN SURFACE AND PAINTINGS:

Surface defects may vary with different surfaces. The most common defects are cracks as shown in Fig 3.3 which can be easily seen in plastered walls, metal sheets etc. These defects not only hinder the painting aesthetics and quality but also to some extent damage some painting tools so it is advised to proper evaluate the surface whether freshly prepared or old and apply a proper remedy

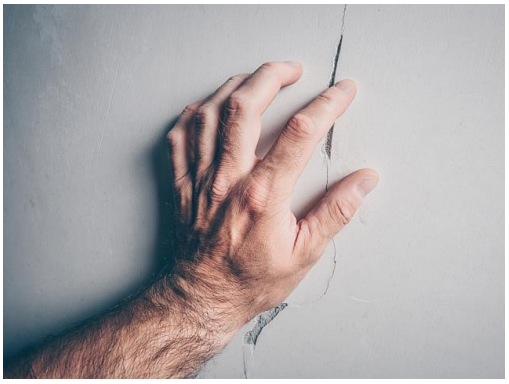

Fig 3.3 Cracks in wall

3.4.1 Common plaster defects

Following are some common defects found in the surface:

1. **Blistering**: Blistering is the most common defect found in plastered surface in which surface is appeared to have grown small patches swelling out beyond prepared surface due to late slaking (addition of water to lime) of lime particles in the plaster. This type of defect usually arises due to uneven mixing of plaster. (Fig 3.4)

Fig 3.4 Blistering defect

2. **Plaster de – bonding:** Over thickened plastered surface, inadequate substrate preparation are the main reasons of separation of plaster from walls as shown in Fig 3.5.

Fig.3.5 Plasterde- Bonding defect

3. **Cracks on plastered surface:**

- **Crazing** – Network of fine cracks like spider web, occurs due to presence of excessive amount of fine content in sand or due to dry base on which plaster is being applied – fines accumulate at the surface when base absorbs water.
- **Separation Crack at Joints** – It occurs due to differential thermal movement of two different materials.
- **Crack with Hollowness** – Could be due to extra water or poor workmanship.

4. **Efflorescence:** Due to presence of soluble salts in plaster making materials as well as building materials such as brick, sand, cement, construction water etc. the salts tend to form a whitish crystalline substance as constructed wall dries out which is known as Efflorescence shown in Fig 3.6.

Fig 3.6 Efflorescence defect

5. **Popping of plaster:** Formation of conical type holes that break out of the plaster is called popping shown in Fig 3.7. It is caused due to presence of contaminants e.g. burnt lime or other organic materials in the mix of mortar.

Fig 3.7 Popping defect

3.4.2 Common painted surface defects

1. Blistering and Peeling: These defects are caused due to swelling of paint film, caused due to formation of air bubble formed due to presence of moisture, oil or grease as shown in Fig 3.8. If caused by moisture and is termed as peeling and if caused by oil or grease, then is called blistering. It can be avoided using porous paints like emulsion an avoid non – porous

Fig 3.8 Blistering and Peeling

paints like oil paints.

2. **Fading:** Fading or Discoloration is caused due atmospheric agencies like sunlight, moisture etc. which can be avoided using proper weathering resistant pigments. (Fig 3.9)

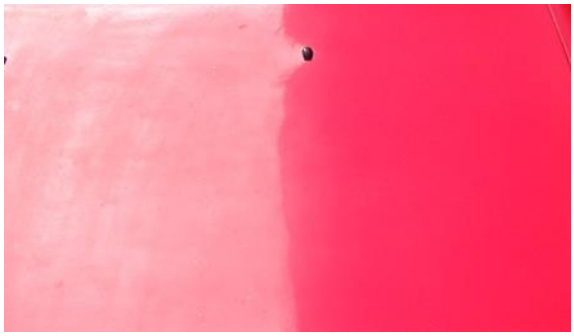

Fig 3.9 Fading Defect

3. **Grinning:** Due to incapability of painted film it shows complete opaqueness even after final coat is termed as grinning.

4. **Chalking:** This is caused due to formation of powder on the surface as shown in Fig 3.10. It is a result of insufficient use of oil in the primer. It can be avoided using sufficient oil in the primer and applying it at a recommended spreading rate.

Fig 3.10 Chalking defect

5. **Running:** When painting a thin film on a glossy and smooth surface, sometimes the paint may run back and leave small areas of surface uncovered, this is called running as shown in Fig 3.11.

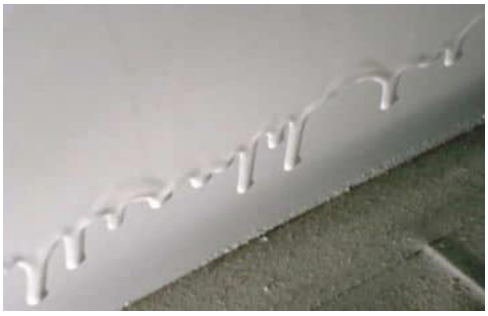

Fig 3.11 Running defect

6. **Sagging**: Whenever a surface is to be painted with a thick film of paint, the paint tends to move downwards due to increased weight of the paint film causing sagging of paint. (Fig 3.12)

Fig 3.12 Sagging defect

Do you know?

The Running and Sagging are differentiated in the way as in Running defect the paint is too thin, so leaves its surface whereas in Sagging it is too thick and due to its weight, it moves downwards.

7. **Flaking:** It is the detachment of painted film from the surface because of improper bond of the film with the surface as shown in Fig 3.13. To avoid it one should use abrasive paper to clean the surface before applying the paint.

Fig 3.13 Flaking defect

8. **Blooming:** In this type of defect, there is formation of dull patches on the painted surface (Refer Fig 3.14). This can have caused mainly due to improper ventilation and other reasons are weathering, defective paint etc.

.

Fig 3.14 Blooming defect

9. **Wrinkling:** This defect is also observed when a surface to be covered with a thick film of paint and in such a case the paint shrinks and develops crawls on the surface as shown in Fig 3.15. This can be avoided by letting the undercoat to dry completely before applying the final coat.

Fig 3.15 Wrinkling defect

10. **Alligatoring:** This defect is pattern cracking similar to alligator scales (Refer Fig 3.16). It occurs when a hard coat of paint is applied over a soft coat of paint. To avoid this, a high-quality oil-based primer should be applied as a prime coat.

Fig 3.16 Alligatoring

11. **Mildew:** It is a form of fungus which grows well in a warm moist and dark environment. They grow rapidly and form grey patches on the painted surface. It can be prevented by keeping the surface dry and clean before applying paint. If there is any trace of its growth, then wash the surface with the bleach. (Refer Fig 3.17)

Fig 3.17 Mildew defect

3.5 Surface Preparation

Preparation work like masonry work, crack filling, water proofing etc. should be preferably done before commencing actual painting work. This is also necessary to get the maximum life of the final paint film by doing proper planning for colour scheme and selection of brushes/rollers.

The following precautions with regard to the drying of background should be observed carefully as these will considerably affect the performance of finish.

3.5.1 In case of New Plaster Surface

Surface Dryness: If possible, the plastered surface should be left unpainted for the first few months to allow it harden and dry thoroughly. If not possible, a temporary decoration of soft distemper (non-washable) or a coat of lime may be applied. No attempt should be made to apply paint until the plastered surfaces of new brickwork, concrete or building blocks are thoroughly dry.

Cleaning & Treatment: Before painting, the surface should be thoroughly brushed to remove all dirt and remains of loose or powered materials to provide a mechanical key between surface and paint. Treatment of the surface with solution of acids or salts such as zinc sulphate is not advisable as the risk of alkali attack is not reduced appreciably and efflorescence may be increased.

3.5.2 In case of Old Unpainted Plaster Surface

Surface Dryness: Any source of dampness in walls and ceilings if present should be removed. Any major cracks or defects in the plaster should be cut out in V shape and made good to avoid absorption of water and subsequent shrinkage of the filling. Minor repairs may be made with cement mortar. Fine cracks may be primed and subsequently filled with a putty of suitable consistency made out of enamel, water and whiting powder.

Cleaning & Treatment: Any fungus and algae growth must be completely removed by brushing it vigorously with wire brush and by cleaning it with water. If there is an extensive growth of vegetable material which cannot be removed by brushing, the growth should be destroyed by applying a wash of ammoniacal copper solution. This treatment should be done with greater care on the sunshades, parapets (a low protective wall along the edge of a roof, or balcony) and other horizontal surfaces where water is likely to accumulate during monsoon.

Do you know?

A recommended composition and concentration of the ammoniacal wash shall consist of 7 gram of copper carbonate dissolved in 80 ml liquor ammonia and diluted to one litre with water.

3.5.3 In case of previously painted Plaster Surface

Surface Dryness:

- Any existing paint showing excessive flaking, bleaching, or saponification (presence of yellow soapy runs) should be removed by scrapping and washing and the surface allowed to dry completely.
- Dry distempers and lime wash should be totally removed prior to repainting. It may sometimes be necessary to wet the surface before scraping. This should not be overdone and all surfaces should be perfectly dry prior to the application of any priming coats.
- Previously oil painted surfaces should be sanded thoroughly to remove loose particles and made dull and matt for better adhesion.
- Exterior rough surfaces, previously coated with cement paint, should be wire brushed and washed with water thoroughly and allowed drying. Before painting, ensure that the surface is free from chalking.
- The exterior surface should not be affected by any water or by constant dampness.
- In case of painting during the rains, the surface should be allowed to dry out completely for 2-3 days of total sunshine before commencing painting.

Cleaning & Treatment:

- Any existing fungus or mould growth should be completely removed by scrapping and rubbing down the surface thoroughly with brush and sand paper. The surface should be washed down with clean water and allowed to dry. A coat of fungicidal wash (destroying and inhibits the growth of fungi) should then be applied and allowed to dry after which a further coat should be applied and left for some time to dry thoroughly.

- Local defective patches should be treated individually by removing all loose or softened paint and bringing forward the treated patches with primer and undercoating before applying a fresh coating over the whole area.

3.5.4 In case of metal surface

A proper and adequate surface is a crucial prerequisite for ensuring a high quality and longevity of metal coatings.

Cleaning the surface

To prepare a new metal surface, clean it with mineral spirits (petroleum-based product) to remove any grease and apply a rust resistant primer before painting. For already prepared surfaces that are fine in condition, clean the surface with a dry cloth, de – gloss the surface with light sanding and wipe with mineral spirits for ensuring good adhesion.

Removing loose and peeling paint

Wire brushing, sanding, scraping or simply removing the loose old film with hands, can be done if the old painted surface is in poor condition. Since these are labor intensive tasks, there is a good chance of failure to obtain a proper surface. To minimize it, power tools can be used to remove paint quickly and easily. But, a drawback to use power driven tools is that it can polish the surface making it difficult for paint adhesion.

Removing rust

Removing rust will ensure proper adhesion of newly painted film to the surface as rust can render problems during paint – surface bonding. To restore a surface to its original state which is lightly rusted, a brush can be used to dust off loose rust, sand the area and apply high quality rust – inhibitive primer.

3.6 Materials used for surface preparation

1. **Plaster of Paris –** When finely ground gypsum (contains 79.1% of calcium sulphate and 20.9% water) is heated at a temperature pf 160°C to 170°C, it loses about 14.7 per cent of its water content in the form of steam, the resulting product is called as Plaster of Paris.

Uses of Plaster of Paris:

(i) It is used as a protective coating on walls and ceilings.
(ii) It is used as a moulding and casting agent for decorative elements.
(iii) It is also used for aesthetics finishing touches to the building.
(iv) It is fire resistant, hence used in buildings to avoid fire hazards.

2. **White Cement –** It is a variety of ordinary cement and it is prepared from such raw materials which are free from coloring oxides of iron, manganese or chromium.

Uses of White Cement:

(i) It is used for floor finish.
(ii) It is used for plaster work.
(iii) It is used for ornamental work that adds superior aesthetic values to it.

3. **Painter's Putty - It** is a chemical powder which when combine with water to become composite. It is effectively used in painting.

Uses of Painter's Putty:

(i) It can fill the holes, cracks on the cement or concrete material.
(ii) It helps patch and fills all the gaps with about 1.2 centimetres deep or wide inside the surface.
(iii) It smoothens the wall or wood.
(iv) By hiding the imperfection on the wall or wood, the putty also brings a better appearance for the surface.

Do you know?

There is another material known as spackle used for the same purpose as Painter's putty. Painter's putty will always give much better results compared to spackle. It is designed and manufactured with painters in mind while spackle is designed to joint be compound.

3.7 PRIMING

Paint primer is designed to provide a stable surface that subsequent paint layers can lock onto. Paint primer also helps to hide surface stains and provides a better appearance and stable base surface. There are different primers used such as wood primer, masonry primer etc.

Uses of Primer:

(i) It increases the paint durability.
(ii) It provides better adhesion of paint to the surface.
(iii) Applying primer over new surfaces seals the original material so that the paint doesn't soak into it.
(iv) Primer is usually white; this is to provide a neutral surface to ensure that paint colours show true.

3.7.1 Types of Primer

There are three basic types of primers: oil-based, latex and pigmented shellac primer.

1. Oil-based Primer

These types of primer are ideal for wood (painted or unpainted), steel and other metals, and surfaces with existing paint, such as interior and exterior walls.

Many oil-based primers are good **"stain killers"** and prevent stains from showing through your new coats of paint.

Oil-based primers are ideal for interior and exterior unfinished or bare wood because they seal the porous surface of wood, enabling the coat of paint to better cover the surface. They also prevent or slow down paint peeling, cracking and blistering.

Drawbacks:

(i) Slow drying and release high amounts of volatile organic compounds (VOCs), which can be harmful to people in high concentrations and with prolonged exposure.
(ii) also require that you use harsh thinners and solvents to clean brushes and applicators, and have to be disposed of carefully and properly
(iii) Oil-based primers should not be used on masonry.

2. Latex-based Primer

Latex primers are water-based and ideal for prepping unfinished drywall for painting. They are more flexible and fast drying, and are less brittle than oil-based primers, making them less susceptible to peeling and cracking.

They also can cover and seal in previous minor stains from smoke, lipstick, crayon, etc., but are not as effective at covering stains as oil- and shellac-based primers.

These primers are water-soluble and so are easy to clean. They also come in low- or no-VOC formulas, making them a healthier alternative to oil-based and shellac primers.

3. Shellac Primer

They also are excellent at preventing normal water, rust and smoke stains, as well as wood tannins from bleeding through new paint. They work well on wood, metal, plaster, and even plastic, and are fast drying and highly adhesive. They also can be used with both oil-based and latex paints.

Drawbacks:

(i) These primers are not as versatile as the above two type of primers.
(ii) These gives off more fumes.
(iii) It uses denatured alcohol (ethanol having additives which are poisonous) used a s thinner.

3.8 UNDERCOATS IN PAINTING

Undercoats are often used to seal the unpainted surfaces for painting. Also when a light colour is to be transitioned on a dark colour, these undercoats play a major role. This will allow the top coat to achieve the unrivalled depth of the colour.

3.8.1 Advantages of using Undercoat

(i) It gives the best painting results when the surface is properly prepared.
(ii) It provides a **protective film to the base.**
(iii) It protects from external elements such as **moisture and aggressive environmental conditions.**
(iv) undercoat is very beneficial to fill the **gaps or are voids** on the surface and achieve the **uniform paint on the surface of the wall.**

Do you know?

Both undercoat and primers sound similar but both serve quite different functions. Following are some key differences between the two:

- Primer is the precoat or the first coat which is applied to the surface where painting is to be done whereas Undercoat is the second coat which is applied over the application of primer.
- Primer is used to seal and protect their surface such as plaster and wood while Undercoat is used on the surface which is already painted.
- The primers cannot be used as the last coat on the surface but the undercoat can be used as the last coat on the surface.

Hence, an undercoat is always a primer, but a primer is not always an undercoat.

3.9 PROCEDURE OF APPLICATION OF PAINT

Following steps must be ensured in applying the paint to the surface –

Step 1: To achieve the quality finish to the surface, it is important to prepare the surface properly before the application. The surface should be scrap with the help of sandpaper creasing the uneven elevations.

Step 2: Clean the surface properly and remove the dust and moisture.

Step 3: After the process of scraping and cleaning of the surface, the primer is applied on the surface.

Step 4: After the surface will be completely clean and dried apply the undercoat.

Step 5: Now applied the final coat of the paint to the surface.

3.10 PROCEDURE OF WHITEWASHING THE SURFACE

Step 1: Create a paste by mixing 2 parts calcium hydroxide, also known as hydrated lime, to 1-part water. Mix the 2 ingredients together until the paste is creamy as shown in Fig 3.18. Let the mixture sit overnight.

Fig 3.18 Step 1

Step 2: Create a salt water solution by mixing 2 parts salt with 1-part water as shown in Fig 3.19.

Fig 3.19 Step 2

Step 3: Remove any excess water from the calcium and water mixture in the morning. Stir the mixture again until it becomes a thick paste-like consistency. (Fig 3.20)

Fig 3.20 Step 3

Step 4: Add the salt water mix to your paste as shown in Fig 3.21. Salt was often added to exterior lime wash to make it more durable and drier slower, producing a better finish.

Fig 3.21 Step 4

Step 5: Test the paste mixture by painting it on top of a piece of paper. Watch it dry, if it dries looking coarse and bumpy, the solution is too thick and more water needs to be added. (Fig 3.22)

Fig 3.22 Step 5

Step 6: Add pigments to your whitewash solution as shown in Fig 3.23, if one wants to have whitewash coloured. Add pigments, purchased from a local hardware store, that can be safely added to any paint or plaster mixture

Fig 3.23 Step 6

Step 7: Cover your floors with plastic and clean your walls prior to whitewashing and remove any scuffs or stains. These stains can show through after whitewashing. (Fig 3.24)

Fig 3.24 Step 7

Step 8: Wet the walls by applying water with a paintbrush to the walls. This will help the whitewash spread once you apply the whitewash. (Fig3.25)

Fig 3.25 Step 8

Step 9: Use a wide paintbrush to apply a thick coat of whitewash to the wet walls. It is easiest to apply the whitewash to the tips of the brush and lightly apply it to the wall. (Fig 3.26)

Fig 3.26 Step 9

3.11 PRECAUTIONS DURING APPLICATION OF PAINT

Following precautions must be ensured so that it will not cause any of the defects:

(i) Clean the surface properly and properly apply coat of primer for avoiding bleeding.
(ii) Allow the paint to dry completely before exposing the surface to moisture.
(iii) Ensure joints and cavities are properly sealed.
(iv) Check and repair water seepage.
(v) Carefully prepare the surface, make sure the poor paint is rubbed down to avoid brush marks.
(vi) Stir the paint if necessary. Use new uncontaminated paint.
(vii) When you are applying a second coat of paint, make sure the first coat is completely dry.

Activitiy

Activity 01: Paint a wall of your classroom/lab.

Material required:

1. Paint brush
2. Paint of any colour
3. Plastic sheets for covering floors
4. Water for maintaining the consistency of the paint if required.

Procedure:

1.Collect all the materials required as shown above at one place near the wall to be painted.
2.Spread plastic sheets over the floor and nearby items to avoid any spilling.
3.Open the paint and add water if required under the supervision of your teacher.
4.Insert the paint brush into the paint and start applying it on the wall.
5.Apply gently the paint brush over the wall by dipping it again and again.
6.Similarly cover the whole wall.
Note: Let the wall dry and if required follow the same procedure for second coat.

Check Your Progress

A. Answer the following questions

1. Write down the steps involved in site preparation for interior surface painting.
2. Define the following terms:
    a. Chalking
    b. Flaking
    c. Efflorescence
    d. Blistering
3. How to prepare surface for old unpainted plaster surface? Write steps.
4. Define Plaster of Paris along with its uses.
5. Why primer coat is applied before applying paint?
6. What are the precautions to be taken while painting on the surface of a wall?
7. Give reason: Why salt is added while whitewashing?

B. Fill in the blanks

1. When thin film is painted on a smooth and glossy surface the paint run back, this defect is known as.....
2. The main cause of blooming is improper.....

3. A form of fungus which grew in moist and dark environment is called.....
4. Efflorescence is caused due to excess of ..... in plaster making materials.
5. The usual color of primer is .....

C. Match the following

	Column A		**Column B**
1	Showing complete opaqueness even after final coat	A	Flaking
2	Detachment of painted film from surface because of improper bond of the film	B	Sagging
3	Paint moving down due to its own weight	C	Grinning
4	Network of fine cracks like spider web	D	Fading
5	Decolourisaton sue to atmospheric agencies	E	Crazing

Module 4 Metal and Wood Painting

Module Overview
This module provides an overview of painting metal and wooden surfaces. It covers the basic tools needed for metal painting and the role of metal finishes. It details surface preparation for both interior and exterior metal finishes, the types of paints suitable for metal surfaces, and the benefits of metal finishing. The importance of painting on wooden surfaces is highlighted, along with various wood finishes. The module explains the process of surface preparation, the materials and tools required, different types of paint, procedures for painting wooden surfaces, and necessary precautions.

Learning Outcomes
After completing this module, you will be able to: • Identify the basic tools required for metal painting • Differentiate between interior and exterior metal finishes • Describe the procedure of metal and wood painting.

Module Structure
4.1: Basic tools for Metal painting
4.2: Role of Metal finishes
4.3: Surface Preparation for Metal painting
4.4: Interior and Exterior metal finishes
4.5: Types of paints for metal surfaces
4.6: Benefits of Metal finishing
4.7: Importance of painting on wooden surface
4.8: Type of wood finishes
4.9: Method/Process of surface preparation
4.10: Material and Tools required for painting work
4.11: Types of paint
4.12: Different Procedure for wooden surface painting
4.13: Precaution during painting work

4.1 BASIC TOOLS FOR METAL PAINTING

It is more challenging to paint a metal surface rather than painting other surface such as wood or plaster as paint doesn't stick well to a metal surface as it does in other surfaces. Also, metal is prone to rust, hence it requires proper surface preparation before application of paint.

Following are the basic tools required precisely for painting metal surface as shown in Fig. 4.1.

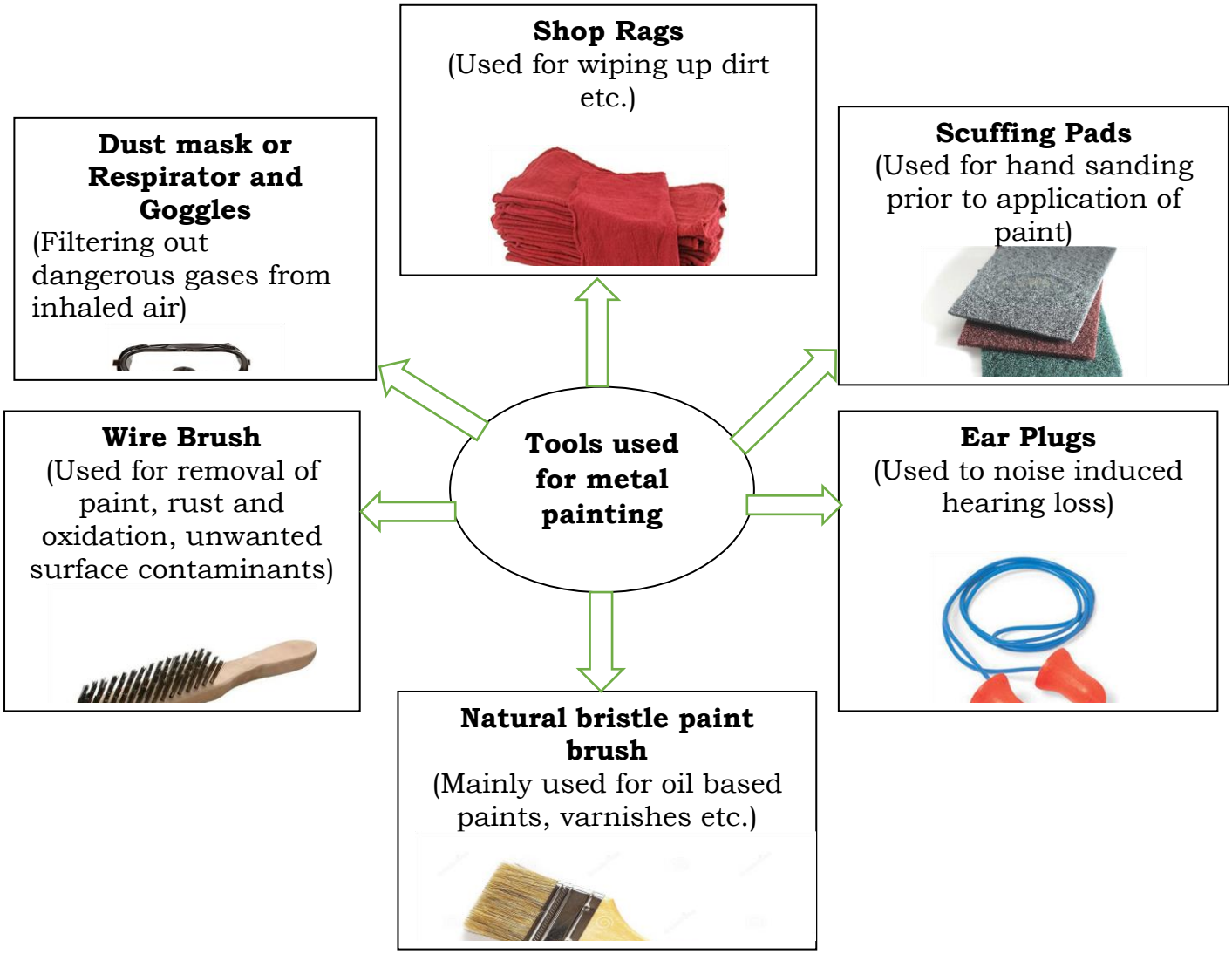

Fig 4.1 Tools used for metal painting

4.2 ROLE OF METAL FINISHES

The quality of metal decreases due to various deteriorating factors like rust and wear caused by air pollutants, chemicals, normal wear and resistance to corrosion. Continuous use of such effected, rusted metal will lead to damaging of surfaces. Hence, to protect the metal, various type of remedial measure is adopted. Mostly metal finishing is carried out to protect the metal surface.

Metal finishes improves the surface in following ways:

1. Makes the surface durable
2. It acts as a safeguard against corrosion.
3. It enables resistant against any chemical and abrasion.
4. It enhances the appearance of the surface.

4.3 SURFACE PREPARATION FOR METAL PAINTING

During metal finishing process, various steps like cleaning, polishing or specialized treatment are carried out. Due to these finishing processes, metal surface leads to improve appearance, adhesion or wettability, corrosion resistance, tarnish resistance, chemical resistance, wear resistance, hardness etc. Before painting, its surface preparation steps needed to be done.

In the absence of appropriate surface preparation, even premium or advanced metal primers or metal enamel paints may end up losing their shine. Following are some steps that involves the surface preparation along with the process of metal finishing:

1. Clean the Metal Surface

Prior to painting, metal surfaces must be free from any dirt, grease, old paint, and rust. Use appropriate sandpaper or any other scraping tool to remove dirt, grease, and other deposits from the metal surface.

Tip - Avoid cleaning with water as it doesn't effectively work on the metal surface.

2. Eliminate Loose or Peeling Paint

When applying new metal paint, any old paint that is loose or is peeling away must be completely removed. Hand wire brushing, scraping, and sanding are a few manual methods for removing such paint deposits. While methods such as power tool cleaning may yield quick results, they may also end up polishing the metal surface, leading to potential adhesion problems.

3. Get Rid of Rust Deposits

Rust interferes with the adhesiveness of paint, making it important to get rid of it before applying the metal paint. Light rusting can be restored with the help of brushing, sanding, and applying an appropriate high-quality primer with rust-inhibition properties. Applying any paint over a rusted surface will also end up damaging and lead to the rusting of the metal paint itself.

4. Apply the Right Primer

Priming is one of the most important steps prior to the application of metal paint. While a water-based primer is not to be applied on metal surfaces, other primer options such as rust-inhibiting primers, galvanized primers, and iron oxide primers are more suitable options.

Priming is a significant step in preparing metal for paint, especially if the surface is exposed to moisture. This type of metal is to be covered, and the desired appearance, performance requirements, and environmental conditions should he considered to select the suitable primer.

Do you know?

Applying the primer immediately after surface preparation can help keep away flash rusting or dust accumulation.

4.4 INTERIOR AND EXTERIOR METAL FINISHES

Interior finish: It is the most common type of paint aside from metal. It is mainly used for interior doors, window frames, skirtings, and bannisters; in fact, anywhere needs extra setbacks. Interior paint contains a mix of additives designed to provide consistent coverage. This makes it easier to pain.

Exterior finish: Ideal for metal downpipes, railings, gates, warehouse areas and bungalows. This paint aims to protect from rusting. You will need to buy a different colour if there is already rust on the metal surface; however, you may not need to remove the rust and use a primer with the right colour. Exterior finish paint will stand up to weather and moisture issues more readily than indoor paint. These finishes withstand more on environmental factors that can led to deterioration of the surface.

4.5 TYPES OF PAINTS FOR METAL

There are different types of paints that can be used to paint the metal surfaces. It must be ensured that the paint which is to be applied on the surface must possess better binding property with the metal so that it doesn't get easily shed out after a period of time. It must also have a glossy appearance for the aesthetic point to view.

Following are some commonly used paints for the metal surfaces-

1. Acrylic paint: These compounds are characterized by long-term protection of metal products and structures from corrosion.

- The material has a long assistance life; it does not crack and fade and provides reliable protection to metal products from corrosion.
- The painted coating safely resists high temperatures; therefore, acrylic compounds can be used for colouring heating radiators.
- The composition is not combustible and non-toxic has no unpleasant odour; therefore, it can be used for external and internal works.

2. Alkyd paint: This is widely used for painting galvanizing and other metal surfaces

Do you know?

Painting is just one part of the process. But while painting it must be some precautions must be taken which are as follows:
1. Cloth or leather gloves for skin protection especially during sanding and scraping.
2. Eye goggles, glasses or masks to protect your face from chemicals.
3. Anti-dust masks to keep your lungs healthy
4. Ear protection if your painting equipment is noisy.

outdoors and indoors.

- Alkyd formulations have a relatively high degree of adhesion.
- Such formulations are highly comfortable and suitable to apply.
- When working with alkyd paint, it should be remembered that the design is quite explosive, so you cannot use it for heating parts of metal structures.

3. Oil paint: It is a colouring material based on drying oil, mainly extracted from natural oils. Such paints are intended only for internal colouring. If you use oil paint outdoors, then under sunlight, it will fade very quickly and crack. In addition, rust will begin to appear under the paint.

- Oil paint more refers to the category of decorative materials. After its application, a reasonably attractive coating is formed.
- Such formulations are well suited for colouring household products.
- The paint is unstable to temperature changes.

4. Epoxy paint: This is a quite toxic material, so it is rarely used and practically does not spread. It is strictly prohibited to paint household products with such a composition. However, it is well suited for an external metal surface subject to high temperature since it can easily withstand it.

5. Hammer paint: This paint has an epoxy, alkyd and acrylic base and consists of sufficient glass and aluminium powder. The coating painted with such a design has a rough surface with a rather noticeable sheen and a texture similar to hammering.

- The paint has exceptional resistance to moisture, vibration, and significant temperature fluctuations.
- It has a relatively broad range of colours and a mixture of textures.
- A two-layer coating with such a composition replaces the primer and the topcoat.

4.6 BENEFITS OF METAL FINISHING

1. Enhanced Aesthetics: One of the most important benefits of metal finishing is improving its overall appearance. Metal finishing involves removal of any sharp edges, cleaning the surface and then smoothing it. Different textures can also be provided as well as other decorative options including glass beading, metal polishing, colour application and custom metal plating.

2. Optimize Resistance: The lifespan of a finished product is much longer than an unfinished metal. Metal finishing improve longevity by increase the resistance to wear, which is a major factor in metal disintegration, not allowing it to be able to stand the test of time. An ideal finished metal is also better resistant to abrasion, chemical damage and other deteriorating factors.

3. Easy Cleaning: An unfinished metal is rough by default. By polishing the metal as part of the finishing process, adhesion and contamination are reduced. In addition, the finish significantly reduces the amount of time required to clean it and eliminate the need for harmful chemicals that could be used to achieve a clean surface. These chemicals, if used, can increase the rate of the metal wear

4.7 IMPORTANCE OF PAINTING ON WOODEN SURFACE

Wood paint gives you the freedom to transform the look of your furniture quickly so that you don't get bored sticking to the exact type for a long time. However, it would help comprehend that painting wooden furniture is far different from painting walls or other surfaces.

Painting to wooden surfaces provides a smooth protective cover of the desired paint, with an improved aesthetic impression of wood structure. The excellent quality painting imparts following attributes to the woodwork:

- It is more long-lasting.
- It is more embellished with a smooth finish.
- It is free from bacterial and fungus formation, which are unclean and gives an unattractive look

4.8 Type of wood finishes

The various kinds of wood finishes let us comprehend the two main types of finishes: Infiltrating finish and Exterior finish. As the name suggests the infiltargoes in-depth inside the wood and heals it. While exterior finishes works only on the upper layer of the wood, ridding it of scratches, cracks and paling colour.

Following are the coating and paints used over the wooden surface -

1. Varnish: It is made of oils, resins and thinners or solvents; the varnish finish shows a durable coating with excellent UV protection to wooden surfaces. The wood coating improves its natural look as it doesn't hide its grains. The varnish is available in polished, flat and satin finishes. Refer Fig. 4.2.

Fig 4.2 Applying varnish over wooden surface

2. Paint: They are two types of wood paint finishes - latex and oil-based. Latex paint shows more vital protection than oil paint finish, and it is excellent for furniture and interior wooden surfaces.

(i) Latex paint: Latex spreads very well on the surface of the wall and usually creates an intense, deep color that retains its properties for a long time. Latex has properties that affect the following such as labour safety and durability. As latex paints do not contain harmful solvents and plasticizers, so does not release harmful fumes while painting.

Also, it creates flexible coatings that are resistant to wet cleaning, so that the walls look good even a dozen years after repair.

Do you know?

How to choose a Latex Paint?

First important thing to be considered - what effect you want to get on the painted surface? Emulsions differ in resistance class, which is divided into five levels. Classes I and II are characterized by the highest mechanical strength. They work well in polluted interiors, such as the kitchen or bathroom, in sunny places and on the ceiling. They are ideal for wooden surfaces, i.e. furniture and panels. Depending on what effect you want to achieve, choose a paint with a matte surface.

(ii) Oil based paints: The natural oil in the wood dries out after a point; an oil finish can help fix its nourished condition. Oil finishes improve the wood's natural colour and

improve its longevity, hut they are not significant protection. Linseed and mineral are the numerous mutual types of oil finishes.

3. Shellac: This natural polish finish is obtained from a tree bug and mixed with the organized tree wax and liquor solvent.

- Shellac finishes shows a good cover and a polished shine to almost all wood surfaces.
- Shellac finishes in various colours based on the shade and type of wood you choose.

4. Lacquer: It is the best choice for an extra gloss finish on the wood. This thin and fast-drying solvent nourishes the seeds of the wood and makes the surface shine and look naturally attractive.

4.9 Method/Process of surface preparation

Surface preparation: The surface preparation to obtain the paint should be smooth, free of surface imperfections and clean of all dust &, dirt. It should not cover more than 15% of moisture content.

The method of surface preparation may vary as per the condition of the existing surface. Hence broadly classifying into basic terminologies as - New and Old wood surfaces.

- **New wood surface:** Wood should be kindly tested, dried, and clean of scales, wetness and oil. Priming is nothing but using a premium coat on the surface. The surface is smooth with abrasive paper, and then the first coat of paint is applied to fill all the pores on the surface. The elements used in this prime coat is the same as the subsequent coats, but the quantity ratio can vary.

- **Old wood surface:** The old paint is proper and well, and its removal is unnecessary. In that case, the surface was rubbed down with sandpaper to clear all dust and loose paint after scrubbing all smoke and oil. If required, the at shall be removed by washing with lime/washing soda and rinsing with water. If the old surface is blistered or badly flaked, it should be removed entirely with a knife, sandpaper etc.

- Prepare a kg caustic soda solution in 5 liters of water and apply it to the old painted is spread easily to the surface. The old paint gets dissolved and removed easily.
- Another method is to prepare a hot solution consisting of soft soap. potash, and quicklime ratio (7:2:1) is applied on the old surface and washed with hot water.

- The washing soda and quick lime mixture is prepared and applied on the old paint surface and then washed with water.

After applying the three methods, the surface is ready for a new painting.

4.11 Material and Tools required for metal and wood painting work

The tools and the materials required for painting are thoroughly discussed in second unit of this book. Following are specifically used in metal and wood painting work:

- **Step ladders and extension ladders** - to help you reach elevated areas.
- **Paint scraper** - to remove loose or peeling paint from wood, plaster, and other surfaces.
- **Triangular-load scraper** - to remove paint in small or tight areas.
- **Steel wool** - to remove corrosion from metal surfaces.
- **Bristle brush** - to clear loose material from masonry
- **Wire brush** - to remove efflorescence and loose material from masonry, or to remove loose, flaking paint
- **Putty knife** - to scrape away loose paint, or to apply filler
- **Broad putty knife** - to fill in and smooth patching compounds in plaster and wallboard
- **Glazing compound** - to replace cracked, broken, or missing panes of glass
- **Spackling paste** - to fill nail holes and small imperfections in walls
- **Long-handled brush** - to clean large exterior surfaces
- **Scrub brush** - to remove mildew and dirt
- **Sandpaper (various grits)** - to smooth and feather previously painted surfaces, or to roughen glossy surfaces so paint will adhere better
- **Sanding block** - to hold sandpaper and help you sand surfaces to an even finish
- **Caulking gun** - to apply caulk to cracks in walls, gaps, and seams in woodwork, and the junction of different surfaces (e.g., wood siding and stone)
- **Masking tape** - to protect window panes and trim from paint
- **Paint guide** - to protect carpets and walls when painting baseboards and other trim.

4.10 Type of Paint:

Type of paint	Preparation of surface
Oil paint	A thin primer coat or prime sealer
Emulsion paint	Paint thinned coat with water
Dry distemper	The same distemper is thinned with water.
Size hound distemper	A Coat of clear Cole
Cement paint and lime wash	Just wet the surface before applying

4.12 Different Procedure for wooden surface painting

- **Primer Coating**: It is involved in filling the pores of wood & provides bonding between the paint flicks and smooth the surface, making it less absorbent and increasing the paint's spreading capacity. Primer is prepared at the site, or readymade colour of approved brand/manufacturer shall be used.
- **First primer coat**: The primer coat shall be applied after surface preparation and thorough wood drying.
- **Second primer coat**: Applied putty between two primer coats, then painting on putty shows a variable formation.

4.13 Precaution during painting work

- Use the only decent brand and ISI mark painting.
- Do not use old paint; normally, the life of paints is three years in original tightly closed containers kept away from direct sunlight and excessive heat.
- Do not add a lighter unless specified by the manufacturer.
- Thinning shall not be done beyond as defined by the manufacturer, as over-thinning will impact the paint performance. Usually, the surface coverage of enamel paint is 90-120 sq. Ft./coat.
- Paint should be shifted before application and shall be of the proper viscosity
- The painting area should be well circulated and free from dirt and dust.
- Do not paint on humid or rainy days or when it is too cold.
- Use proper brush only. For Just wet the surface before applying.
- All the furniture's and valuables should be protected with wet clothes to guard against any possible damage due to spillage of paint.
- The putty around the glass panes shall also be painted for painting doors and windows.
- Ensure proper application of each coat of paint for uniformity of thickness.
- It ensured that the painted surface was free from paint drips, waves, and uniform colour, texture, and finish.
- The drying time of enamels is more protracted, hence ensuring a dust-free environment while the paint film is drying.

Activity

Activity 1: Differentiate between paints used in wood surface and metal surface.
Material Required
1. Pen
2. Wood paints
3. Metal paints
Procedure

1. With the support of your teacher, go to paint shop.
2. Tell the shopkeeper to show all the paints used in metal and wood surfaces.
3. Enlist all types of paint shown to you.
4. Make separate list of paints used for wood surface and metal surface too.

Check Your Progress

A. Answer the following question

1. Describe the process of metal painting to achieve required finished surface?
2. What is role of metal finish?
3. What are the difference between interior and exterior metal finish?
4. Which type of material arc required for metal painting?
5. How is Painting wood different from painting other surfaces?

B. Fill in the blanks

1. …….. preparation is key to ensuring the quality and longevity of metal paint and other coatings.
2. …….. paint is widely used for painting galvanizing metal surfaces outdoors and indoors.
3. The paint which is quite toxic and doesn't spread easily is …….. paint.
4. …….. brush is used for removal of paint rust, oxidation and unwanted surface contaminants.
5. …….. Is made up of oils, resins and thinner that shows durable coatings with excellent UV protection.

C, Match the following

Column A	Column B
(1) Wiping up dirt	(a) Ear Plugs
(2) Filtering out dangerous gas from inhaled air	(b) Shop Rags
(3) Noise induced hear loss	(c) Dust mask
(4) Hand sanding prior to application of paints.	(d) Scuffing pads

Module 5	Introduction to Environment, Health and Safety

Module Overview
Human safety is of utmost importance. While performing any task or operation, one must ensure all the safety measures. 'EHS' stands for Environment, Health, and Safety. It's a general term used to refer to laws, rules, regulations, professions, programs, and workplace efforts to protect the health and safety of employees and the public as well as the environment from hazards associated with the workplace. This module introduces environmental health and safety (EHS) in the context of construction painting. It emphasizes the importance of protecting workers and the environment during painting projects. Key topics include the safe handling of paints and chemicals, proper waste disposal, and the use of personal protective equipment (PPE) such as masks, gloves, and goggles. The module aims to ensure a safe working environment, prevent accidents, and promote sustainable practices in construction painting.

Learning Outcomes
After completing this module, you will be able to: • Understand the basic principles of environmental health and safety in construction painting. • Identify potential hazards associated with painting projects and implement measures to mitigate them. • Understand the importance of using personal protective equipment and its usage.

Module Structure
5.1 Role of Personal Protective Equipment (PPE)

5.1: Personal Protective Equipment (PPE)

Environment is the natural world around you and in the context of compliance, the 'E' of EHS indicates the regulations that are designed to protect the environment. The 'S' refers to regulations intended to protect the safety of employees on worksites and the 'H' is the health of employees. Often 'H' and 'S' are merged together and regulated by the same agency, whereas, the 'E' is regulated by a specific environmental agency.

Painters work at a variety of workplaces, construction sites, homes, etc. and face a constantly changing set of hazards. Safety measures must be ensured for avoiding the hazards.

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to a variety of hazards. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (earplugs, muffs) hard hats, respirators and full body suits.

Personal protective equipment (PPE) is the equipment or a device which is intended to be worn or otherwise used by an employee at work and which protects the employee against one or more risks arising from the operation to the employee's safety or health. It includes any addition or accessory to the equipment designed to meet a similar objective. It protects the employee from hazards and any harmful conditions (existing and potential) which may result in injury, illness, or possibly fatal injury.

'PPE' can be an item worn on the body, such as gloves, or a device, such as a protective shield or barrier. Besides face shields, safety glasses, helmets, and safety shoes, personal protective equipment also includes a variety of devices and garments such as goggles, coveralls, gloves, vests, earplugs, and respirators. Examples of some of the personal protective equipment's are given in Fig 5.1.

Fig 5.1: Examples of personal protective equipment's

PPE is an important means of preventing work injuries. Ideally, the best approach is to maintain a safe work environment and eliminate any potential hazards. PPE is only to be relied upon as a last line of defence in places where it is not practicable to control the hazards at source.

PPE is designed to protect the employee from serious workplace injuries or illnesses resulting from contact with chemical, radiological, physical, electrical, mechanical, or

other workplace hazards. It is one of the ways to protect employees. However, it does not eliminate or reduce the hazard. It only places a barrier between the employee and the hazard. If the PPE fails or is not used, then the employee is not protected from the hazard.

The use of PPE generally implies working in a potentially hazardous work environment and its use is a major means of injury prevention. Therefore, it is of prime importance to ensure that the equipment chosen is both reliable and effective. Also, it is being properly used and maintained, and the user has undergone adequate training.

All PPE equipment and clothing are to be of safe design and construction and are to be maintained in a clean and reliable way. Organization is to take the fit and comfort of PPEs into consideration during their procurement. PPEs are to be appropriate and must meet the requirements of workplace. PPEs which fit well and are comfortable to wear encourage employees to use them. Most PPEs are available in multiple sizes, and care is to be taken to procure PPEs of the proper sizes so as to meet the needs of all the employees. If several different types of PPE are to be worn together, then it is to be made sure they are compatible. If PPEs do not fit properly then they can make the difference between being safely covered or dangerously exposed. In such a case they may not provide the level of protection desired and may discourage employees to use them.

There are following PPE kit are as:

(a) Head Protection: Protecting employees from potential head injuries is a key element of the employee's safety. A head injury can impair and employee for life. It can also be fatal. Wearing a safety helmet is one of the easiest ways to protect an employee heads from injury. Safety helmet can protect employees from impact and penetration hazards as well as from electrical shock and burn hazards. Refer Fig. 5.2.It provides penetration against: -

(i) Hitting of the head by falling objects from above.
(ii) Bumping of the head against fixed objects, such as exposed pipes etc.
(iii) To take care of the possibility of accidental head contact with electrical hazards.

In general, safety helmets resist penetration by objects and absorb the shock of a blow. They are to be water-resistant and slow burning. Employees are to clearly understand the importance of proper adjustment and replacement of the suspension and headband. Safety helmet must have a hard outer shell and a shock-absorbing lining which incorporates a headband and straps which suspend the shell from 2.5 cm to 3.2 cm) away from the head. This type of design provides shock absorption during an impact and ventilation during normal wear.

Head protection which is either too large or too small is inappropriate for use, even if it meets all other requirements. It is important that the safety helmet must fit

appropriately on the head of the employee. The safety helmets normally come in a variety of sizes with adjustable headbands to ensure a proper fit (many adjust in 3 mm increments). A proper fit allows sufficient clearance between the shell and the suspension system for ventilation and distribution of an impact. The helmet is not to bind, slip, fall off or irritate the skin.

Face shield devices can be attached to the helmet without changing the helmet strength and electrical protection. For this, a metal face shield bracket system can be used on the helmet.

Fig 5.2 Head protection

b) Foot and Leg Protection: Employees, who face possible foot or leg injuries from falling or rolling objects or from crushing or penetrating materials, are to wear protective footwear. Also, employees whose work involves exposure to hot substances or corrosive or poisonous materials are to have protective gear to cover exposed body parts, including legs and feet. If an employee's feet are exposed to electrical hazards, nonconductive footwear is to be worn. On the other hand, workplace exposure to static electricity may necessitate the use of conductive footwear.

Foot and leg protection are necessary: (i) when heavy objects can roll onto or fall on the employee's feet, (ii) working with sharp objects such as nails or spikes which can pierce the soles or uppers of ordinary shoes, (iii) exposure to liquid metal which can splash on feet or legs, (iv) working on or around hot, wet or slippery surfaces, and (v) working when electrical hazards are present.

Foot and leg protection choices include: (i) leggings with safety snaps for quick removal which protect the lower legs and feet from heat hazards such as liquid metal or welding spark, (ii) metatarsal guards made of aluminium, steel fibre or plastic to protect the instep area from impact and compression, (iii) toe guards made of steel, aluminium or plastic fit over the toes of regular shoes to protect the toes from impact and compression hazards. Normally the toe box is incorporated into the footwear during construction and is an integral part of the footwear, (iv) combination foot and shin guards to protect the lower legs and feet, and can be used in combination with toe guards when greater protection is needed, and (v) safety shoes which have impact-resistant toes and heat-resistant soles that protect the feet against hot work surfaces.

Electrical hazard, safety-toe shoes are nonconductive and prevent the employees' feet from completing an electrical circuit to the ground. These shoes can protect against open

circuits of up to 600 volts in dry conditions and are to be used in conjunction with other insulating equipment and additional precautions to reduce the risk of the employee becoming a path for hazardous electrical energy.

Safety shoes for the area where liquid metal is being handled must keep liquid metal from lodging in the shoe eyelets, tongues or other shoe parts in addition to insulating the feet from the extreme heat of the liquid metal. These snug-fitting leather or leather-substitute shoes have leather or rubber soles and rubber heels. All such shoes are to have built-in safety toes.

Fig 5.3 : Boot (Foot and Leg protection)

c) Eye and Face protection: Employees can be exposed to a large number of hazards which can pose danger to their eyes and face. Employees need to have appropriate eye or face protection if they are exposed to eye or face hazards from flying particles, liquid metal, liquid chemicals, acids or caustic liquids, chemical gases or vapours, potentially infectious material, or potentially harmful light radiation.

Everyday use of prescription corrective lenses does not provide adequate protection against most occupational eye and face hazards, so it is necessary that employees with corrective lenses either wear eye protection which incorporates the prescription into the design or wear additional eye protection over their prescription lenses.

Examples of potential eye or face injuries include (i) dust, dirt, metal or wood chips entering the eye from activities such as chipping, grinding, sawing, hammering, the use of power tools or even strong wind forces, (ii) chemical splashes, mists and vapours from corrosive substances, hot liquids, solvents or other hazardous solutions contacting the eye from activities such as pickling, degreasing and electroplating, (iii) objects swinging into the eye or face, such as chains, tools or ropes, (iv) radiant energy from welding, harmful rays from the use of lasers or other radiant light (as well as heat, glare, sparks, splash and flying particles).

Selecting the most suitable eye and face protection for employees is to take into consideration:

(i) Ability to protect against specific workplace hazards.
(ii) Need to fit properly and reasonably comfortable to wear.
(iii) To provide unrestricted vision and movement.

(iv) Need to be durable and cleanable.

Some of the most common types of eyes and face protection include the following.

- **Safety glasses** which have safety frames constructed of metal or plastic and impact-resistant lenses. Side shields are available on some models. Safety glasses are not to be used for protection against chemical splashes, mists or vapours.
- **Goggles** are tight-fitting eye protection which completely cover the eyes, eye sockets and the facial area immediately surrounding the eyes and provide protection from impact, dust, mists, vapours and splashes. Goggles with direct ventilation typically are used for impact hazards and dusts, not for protection against chemical splashes or vapours. Goggles with indirect ventilation are used for protection from dusts and splash hazards. Goggles with no ventilation provide protection from dusts, splashes, mists and vapours. Goggles with foam or cloth padding are not to be used for chemical splash protection. Some goggles fit over corrective lenses.
- **Welding shields** are constructed of vulcanized fiber or fiberglass and fitted with a filtered lens. They protect eyes from burns caused by infrared or intense radiant light. They also protect both the eyes and face from flying sparks, metal spatter and slag chips produced during welding, brazing, soldering and cutting operations. The filter lens shade number must be appropriate to protect against the specific hazards of the work being performed.
- **Laser safety goggles** are specialty goggles to protect against intense concentrations of light produced by lasers. The type of laser safety goggles to be used depends upon the equipment and operating conditions in the workplace.

d) Protection of hand and arm: If a workplace is such that the employees face potential injury to hands and arms which cannot be eliminated through engineering and work practice controls then employees are required to wear appropriate protection. Potential hazards include skin absorption of harmful substances, chemical or thermal burns, electrical dangers, bruises, abrasions, cuts, punctures, fractures and amputations. PPE includes gloves, finger guards, and arm coverings or elbow-length gloves. It is extremely necessary that all possible engineering and work practice controls are explored to eliminate hazards and use of PPE is to provide additional protection against hazards which cannot be completely eliminated.

There are many types of gloves available these days to protect against a wide variety of hazards. The nature of the hazard and the operation involved affects the selection of gloves. The variety of potential occupational hand injuries makes selecting the right pair of gloves challenging. No glove provides protection against all potential hand hazards. It is essential that employees use gloves specifically designed for the hazards and tasks found in their workplace since gloves designed for one function may not protect against a different function even though they may appear to be an appropriate protective device.

The factors which influence the selection of protective gloves for a workplace are:

(i) Type of chemicals handled (toxic properties of the chemicals)
(ii) Chemical concentration and temperature (the higher the concentration and temperature, the shorter the breakthrough time).
(iii) Nature of contact (total immersion, continual contact, splash etc.)
(iv) Grip requirements (dry, wet, oily etc.)
(v) Thermal protection
(vi) Size and comfort
(vii) Abrasion /cut resistance requirements and
(viii) Other job hazards (such as biological, electrical, and radiation hazards).

Following are the type of gloves used for hand protection -

1. **Leather, synthetic fiber or metal mesh gloves** are sturdy and provide protection against cuts and burns. Leather or canvas gloves also protect against sustained heat. They protect against sparks, moderate heat, blows, chips and rough objects. These gloves can be used for tasks such as welding. Aluminized gloves provide radiant heat protection by reflection and insulate/reduce heat conduction with a liner or insert. Employees working with liquid metals are benefitted with this type of glove. Aramid fiber gloves protect against heat, are cut resistant and abrasion resistant and wear well. Employees working in jobs such as firefighting, metal fabrication, and ceramic handling are benefitted with this type of glove. Synthetic gloves of various materials offer protection against heat and cold and are cut resistant and abrasion resistant. They also withstand some diluted acids. These materials do not stand up against alkalis and solvents.
2. **Fabric and coated fabric gloves** are made of cotton or other fabric to provide varying degrees of protection. Fabric gloves protect against dirt, slivers, chafing and abrasions. They do not provide sufficient protection for use with rough, sharp or heavy materials. Adding a plastic coating strengthens some fabric gloves. Coated fabric gloves are normally made from cotton flannel with napping on one side. By coating the unnapped side with plastic, fabric gloves are transformed into general purpose hand protection and have slip resistant qualities. These gloves are used for tasks ranging from handling bricks and wire to chemical laboratory containers.
3. **Chemical protective gloves** are made with different kinds of rubber such as natural, butyl, neoprene, nitrile and fluorocarbon (Viton) or various kinds of plastic such as polyvinyl chloride (PVC), polyvinyl alcohol and polyethylene. These materials can be blended or laminated for better performance. Generally, the thicker the glove material, the greater is the chemical resistance, but thick gloves can impair grip and dexterity and have a negative impact on the safety. Different glove materials resist

different chemicals, and glove compatibility can vary from manufacturer to manufacturer. Butyl gloves are made of a synthetic rubber and protect against a wide variety of chemicals, such as peroxide, rocket fuels, highly corrosive acids (nitric acid, sulphuric acid, hydrofluoric acid and red-fuming nitric acid), strong bases, alcohols, aldehydes, ketones, esters and nitro compounds. Butyl gloves also resist oxidation, ozone corrosion and abrasion, and remain flexible at low temperatures. Butyl rubber does not perform well with aliphatic and aromatic hydrocarbons and halogenated solvents. Natural (latex) rubber gloves are comfortable to wear, which makes them a popular general-purpose glove. They have exceptional tensile strength, elasticity and temperature resistance. In addition to resisting abrasions caused by grinding and polishing, these gloves protect employees' hands from water solutions of acids, alkalis, salts and ketones

4. **Rubber insulating gloves** are meant for protecting against electrical shock. These gloves are available to meet different voltage exposures. Lightweight low voltage gloves are for use on voltages under 1,000 volts. Gloves for use on high voltage are of thicker material for the dielectric strength. As the use voltage rating increases so does the glove weight. Rubber gloves are to be visually inspected and an 'air' test is to be performed before they are used. Electrical protective equipment is to be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests are to be as per the appropriate standards.

5. **Protective gloves** are to be inspected before each use to ensure that they are not torn, punctured or made ineffective in any way. A visual inspection helps detection of cuts or tears, but a more thorough inspection by filling the gloves with water and tightly rolling the cuff towards the fingers helps revealing any pinhole leaks. Gloves which are discoloured or stiff can also indicate deficiencies caused by excessive use, age or degradation from chemical exposure. Any gloves with impaired protective ability are to be discarded and replaced. Reuse of chemical-resistant gloves is to be evaluated carefully, taking into consideration their absorptive qualities. A decision to reuse chemically exposed gloves is to take into consideration the toxicity of the chemicals involved and factors such as duration of exposure, storage and temperature.

e) Body protection: Employees who face possible body injury of any kind which cannot be eliminated through engineering, work practice or administrative controls, are to wear appropriate body protection while performing their jobs. In addition to cuts and radiation, there are other workplace hazards which can cause body injury.

These hazards are (i) temperature extremes (ii) hot splashes from liquid metals and hot liquids (iii) potential impact from tools, machinery and materials and (iv) hazardous chemicals.

There are many varieties of protective clothing available for specific hazards. Employees are required to wear personal protective equipment only for the parts of the body exposed to possible injury. Examples of body protection include laboratory coats, coveralls, vests, jackets, aprons, surgical gowns and full body suits. Full body suits can further be categorized into fully encapsulating suits, non-encapsulating suits, firefighter's protective clothing, proximity or approach clothing, blast or fragmentation suits, and radiation protective suits. All of these necessitate the use of protective boots, gloves and hoods as well. Totally encapsulating chemical protective suits are to be capable of maintaining positive air pressure and prevent inward test gas leakage of more than 0.5 percent.

- **Protective clothing** comes in a variety of materials, each effective against particular hazards. Paper like fiber is used for disposable suits and it provides protection against dust and splashes. Treated wool and cotton adapts well to changing temperatures. It is comfortable and fire-resistant, and protects against dust, abrasions and rough and irritating surfaces.

f) Hearing protection: Determining the need to provide hearing protection for employees can be challenging. Employee exposure to excessive noise depends upon a number of factors which include:

(i) The loudness of the noise as measured in decibels (dB)

(ii) The duration of each employee exposure to noise.

(iii) Whether employees move between work areas with different noise levels, and

(iv) Whether noise is generated from one or multiple sources.

Generally, the louder the noise, the shorter the exposure time before hearing protection is required. For example, employees can be exposed to a noise level of 90 dB for 8 hours per day before hearing protection is required. On the other hand, if the noise level reaches 115 dB, hearing protection is required if the anticipated exposure exceeds 15 minutes. Noises are considered continuous if the interval between occurrences of the maximum noise level is one second or less. Noises not meeting this definition are considered impact or impulse noises (loud momentary explosions of sound) and exposures to this type of noise are not to exceed 140 db.

Examples of situations or tools that may result in impact or impulse noises are powder-actuated nail guns, a punch press or drop hammers.

g) Other types of personal protective equipment

1. **Respiratory protective equipment:** Respiratory protective equipment is used to prevent dangerous chemicals from entering the respiratory system of the wearer. It is also used to provide breathing air when working in a dangerous environment

where there is risk of oxygen deficiency or presence of dangerous chemicals in the air at high concentrations.

There are three basic classes of respirators which are normally used:

(i) Air purifying respirators

(ii) Air supplied respirators

(iii) Self-contained respirators.

Air-purifying respirators: Used to remove contaminants from the inhaled air. They are not suitable for use in an environment which is deficient in oxygen. The types of air purifying respirators are given below.

Particulate filter respirators: These consist of a face piece and a filter unit. Filters of various pore sizes are available for different type and size of particulate matter. They do not offer any protection against gases or vapours and are generally used for non-emergency exposures.

Chemical cartridge respirators: These consist of a face piece normally fitted with an exhalation valve and connected directly to one or two chemical cartridges filled with a limited quantity of granular sorbent. They are useful for protecting against specific vapours and gases of low toxicity. Different types of contaminants require different types of chemical cartridge.

Gas masks: These consist of a full-mask face piece, which covers the eyes, nose and mouth, connected either directly or via a non-kink flexible hose to a canister containing a granular sorbent.

Hose masks (with or without blower): These consist of a full-mask face piece, with inhalation and exhalation valves, connected by a flexible hose to a breathing air supply. The air is blown in either by the user's respiratory effort (without blower) or supplied under pressure by a hand operated or power-operated blower (with blower). The hose mask with blower is considered safe for work in atmospheres where there may be dangerous concentrations of dust, fumes, vapour or gas.

Airline respirators: These respirators consist of a full mask or half mask face piece supplied with air through a hose from a compressed air source. Airline respirators are used in atmospheres which are not immediately dangerous to life, and offer the most acceptable form of personal protection in operations requiring continuous use of respirator.

Abrasive blasting respirators: These respirators are designed specifically to protect the employees engaged in shot, sand or other abrasive blasting work where the air is contaminated with high-velocity particles. The respirator is essentially an airline respirator with additional mechanical protection in the form of a full mask (with hood and cape) or a rigid helmet.

Air supplied hoods: These are similar to the hood-type abrasive-blasting respirators but are of lighter construction and have a larger viewing panel. They are generally of the disposable type and are particularly suitable for spray painting and grinding work. It is essential that air supplied from the compressor is not contaminated with carbon monoxide or other gaseous contaminants which can come for example from the exhaust system of the compressor.

h) **Safety belts and full protection system for working at heights:** For working at heights, it is necessary to adopt basic safety precautions including the provision of suitable working platforms, safe access and egress and the erection of suitable guardrails at hazardous locations. If these safety precautions are not feasible, safety belts are to be used.
Common types of safety belts are:
(i) With full body harness to be used to prevent falls, and

(ii) General purpose safety belt and its lanyard are to be used to restrict movement while working.

In addition to a safety belt, the entire fall protection system for working at heights is also to consider the area surrounding the worksite so as to, for example, prevent striking against nearby structures in the event of a fall. Environmental factors are also to be taken into account so as to avoid high temperatures or smoke affecting the performance of each of the components of the system.

i) **Protective clothing for welding and high heat:** Coveralls, jackets, pants and aprons are available for operations involving high heat or liquid metal splashes. Leather is the traditional protective material for many welding operations. Where there is exposure to radiant heat as well as liquid metal splashes, aluminized garments can be used. They reflect up to 95 % of the radiant heat.

Flame-resistant cotton coveralls, designed for comfort as well as protection, are sometimes preferred. Whatever the type of clothing used for welding operations, it is not to have external pockets or cuffs. Fabrics of silica, ceramic and fiberglass eliminated the need for asbestos and are now available for welding operations.

Activity

Activity: Assign all the safety equipment used in painting in a board and assemble it in your classroom.
Material Required
1. Hard board
2. Nails of attaching the safety equipment tools
3. PPE

Procedure

1. Collect all the safety tools used in painting.
2. With the help of the trainer, Assign the various safety equipment's on the board.
3. Enlist their functions and usage.

Check Your Progress

A. Answer the following questions

1. What does PPE mean?
2.What type of gloves are used while working with chemicals?
3.Define the basic classes of respirators.
4.What type of protection is applied over foot and leg?
5.Enlist the personal protective equipment used.

B. Fill in the blanks

1. …….. are tight fitting eye protection which completely cover the eyes, eye sockets and facial area surrounding the eye.
2. …….. insulating gloves are meant for protecting against electrical shocks.
3. …….. Shields protect both the eye and face from flying sparks, metal spatter and slag chips produced during bracing, soldering and cutting operation.

Answer Key

Unit 1: Introduction to Construction Painting

B. Fill in the blanks

1. Personal
2. Interior
3. Solvent
4. Blue
5. Drier

C. Match the following

1. E
2. A
3. D
4. B
5. C

Unit 2: Painting tools and their Maintenance

B. Fill in the blanks

1.Angles Sash
2. Thin, straight
3.Corner edges
4. Chip

C. Match the following

1. C
2. E
3. A
4.B

5. D

Unit 3: Painting Procedure

B. Fill in the blanks

1.Running
2. Ventilation
3.Mildew
4. Soluble salts
5.White

C. Match the following

1-C
2-A
3-B
4-E
5-D

Unit 4: Metal and Wood Painting

B. Fill in the blanks

1.Surface
2. Alkyd
3. Epoxy
4. Wire
5.Varnish

C. Match the following

1-B
2-C
3-A
4-D

Unit 5: Introduction to Environment, Health and Safety

B. Fill in the blanks

1. Goggles
2. Rubber
3. Welding

Glossary

Abrasion: *the process of rubbing, grinding or wearing way of something by friction.*

Adhere: *to stick by or as if grasping, gluing or fusing.*

Adhesion: *is the ability of molecules/particles of a different substance to stick to each other.*

Aesthetics: *The visual appeal or beauty of a painted surface or design.*

Blunt end: *The non-sharp end of a tool, such as a brush, used to avoid damage during application.*

Brickwork: *The construction or surface made from bricks, often requiring specific painting techniques.*

Bristles: *The stiff, hair-like components of a paintbrush used for applying paint.*

Ceiling: *The upper interior surface of a room, which can be painted to improve appearance.*

Combustible: *Materials that can catch fire easily and need careful handling during painting.*

Consistency: *The thickness or thinness of paint, affecting how it applies and dries.*

Corrosion: *The deterioration of metal surfaces due to chemical reactions, often requiring special paints.*

Dampness: *Presence of moisture in surfaces, which can affect paint adhesion and finish.*

Deterioration: *The process of decline in the quality or appearance of painted surfaces over time.*

Distemper: *A type of paint made from water, pigment, and a binder, often used for interior walls.*

Embossed: *A textured surface where paint creates a raised pattern or design.*

Ergonomic: *Design that enhances comfort and efficiency, important for painting tools and equipment.*

Fissures: *Small cracks or splits in surfaces that need to be repaired before painting.*
Flaked: *The peeling or chipping off of paint from a surface.*

Galvanized: *Metal coated with a protective layer of zinc to prevent rust, requiring special paint.*

Latex caulk: *A flexible material used to seal gaps and joints before painting.*

Multifaceted: *Having many aspects or features, such as complex painting techniques.*

Paling colour: *A lighter shade or less intense colour, often used to complement other colours.*

Panes of glass: *Flat pieces of glass in windows or doors, which may need protection during painting.*

Pesticides/Fungicides: *Chemicals used to control pests or fungi that can damage painted surfaces.*

Plasticizers: *Additives that increase the flexibility and workability of paint.*

Polyester: *A synthetic material used in some paints and finishes for durability.*

Rinse: *To wash or clean a surface with water to remove dust or debris before painting.*

Rust inhibition: *The process or chemicals used to prevent rust formation on metal surfaces.*

Scraping: *Removing old paint or debris from a surface to prepare it for new paint.*

Slaked: *A term used to describe lime that has been treated with water to make it suitable for use in paint.*

Slant: *An angled or tilted surface which may require special painting techniques.*

Spillage: *Unintentional release of paint or other materials, which needs to be cleaned promptly.*

Stain: *A coloured substance used to enhance or change the colour of a surface, often wood.*

Tannins: *Natural compounds in wood that can affect the adhesion and colour of paint.*

Tarnish: *The dulling or discoloration of metal surfaces over time, requiring cleaning before painting.*

Uncontaminated: *Free from substances that could affect the quality or adhesion of paint.*

Undulations: *Surface irregularities or waves that need to be smoothed before painting.*

Ventilation: *The process of ensuring adequate airflow to remove fumes and ensure safe painting conditions.*

Volatile organic compound (VOC): *Harmful chemicals in paints that can evaporate into the air, affecting air quality.*

Weathering: *The process of natural exposure to elements like sun and rain, which can affect the durability of paint.*