

## CMPT306 BASICS CONSTRUCTION SKILLS

### Learning unit 1: Use tools, materials and equipment

#### 1.1. Use PPE for basic construction works

Introduction to PPE used for plastering, joinery and pavement

Definition: PPE's a protective equipment or wearing protective clothing which are used to protect workers from accident.

Function: of PPE to protect workers from accident, dust and bad air (fumes).

Types of PPE for plastering, joinery and pavement

- Helmet
- Gloves
- Goggles
- Dust mask
- Overall
- Safety shoes etc.

Usage and Maintenance of PPE for plastering, joinery and pavement.

Safety tool and equipment at work site varies depending on the type of activity you are going to carry out but there are common safety equipment for every activity like **PPE** (personal protective clothes).

The following are some of safety tools and equipment and their functions:

- ❖ **Helmet:** protect head from overhead falling materials
- ❖ **Face mask:** protects face from the harm that may be caused by fumes of chemical products
- ❖ **Overall:** protects body from getting dirt due to the dusts
- ❖ **Hard boots:** protects feet from being hurt by nails or any other sharpening objects
- ❖ **Hand Gloves:** protect hand from sharpening objects and contaminants which can cause irritation
- ❖ **Goggle:** protects eyes from dust, fumes,...

- ❖ **DUST MASK, FACE MASK, RESPIRATORS:** this will give protection against general dust inhalation or fumes e.g. when drilling in a confined space.
- ❖ **EAR PROTECTORS:** are used to protect noise mostly in the workshop same form of ear protection is necessary to wear either cotton ear plug or full protectors.
- ❖ **Safety symbols:** these symbols that notifying any hazard that may occur
- ❖ **Fire extinguisher:** safety tool which is used as first aid in fighting fire
- ❖ **Emergency alarm:** a ringing bell which is used to inform every one that there is a hazard which is happening

#### Advantages of using PPE's

- ❖ 1. They avoid accidents
- ❖ 2. They protect our bodies against injuries
- ❖ 3. They prevent hazards
- ❖ 4. They protect us from dust

#### Disadvantages of PPE's

- ❖ 1. Needs money to buy.
- ❖ 2. Transport costs
- ❖ 3. over size
- ❖ 4. Stolen
- ❖ 5. Lost

Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure. The “something” could be tool equipment.

## 1.2. Operate tools and equipment for plastering, joinery and pavement.

**What is a tool?** A piece of equipment which you use with your hands to make or repair something or a tool is something you need to use to do your job easily e.g. *Power tools or machine tools.*

Classification of tools and equipment for plastering, joinery and pavement

1. Setting out tools
2. Cutting tools
3. Mixing tools
4. Cleaning tools/equipment

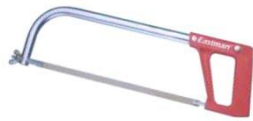
Example of Setting out tools

Tape measure, Plumb bob, spirit level and hose pipe.



### 1. Cutting tools

Pick axes, Hacksaw, Pincers, Chisel, machete



### 3. Mixing tools

Hoes

Shovels/spade

Mixer

Different methods of cleaning any tool and equipment

By water

By drying

Greasing

Greasing is done to make free movement of machine parts when it is working oil is also put on machines or tools to prevent rusting on them.

### 1.3. Use materials for construction works

☒☒Types of materials for plastering, joinery and pavement works.

Sand

Cement

Water

Filler

☒Timber

#### *a. Cement*

Cement is a mixture of 60 to 67% lime, 17 to 25% silica and 3 to 8% alumina, which are intimately mixed together with water to form into a slurry, which is subsequently heated, dried, calcined and ground to a very fine powder. A small proportion of gypsum is added before grinding in order to control the rate of setting.

For ordinary brick masonry work it is recommended to use ordinary Portland cement in order to achieve a good mortar in strength and durability.

The indication of damaged cement is given by the presence of large lumps of set cement. These lumps of set cement should not be used, not even if screened again.

#### ***b. Sand***

Sand is very essential building construction raw material and deserves special attention. Material passing on a 4.75 mm sieve is classified as fine aggregate or sand.

Sand, which contains 90% of particles of size greater than 0.06 mm and less than 0.2 mm, is fine sand.

Sand, which contains 90% of particles of size greater than 0.6 mm and less than 2 mm is coarse sand.

The quality of the mortar is directly linked to the characteristics and condition of the sand. Sand must be free from clay, loam, vegetables and any other organic material.

Clay or dirt coating on aggregates prevents adhesion of cement to aggregate, slows down the setting and hardening process and reduces the strength of the mortar. Therefore, clay and silt content should not exceed 10%, otherwise the sand needs to be washed.

Sea sand is unsuitable for mortar as it contains salts, which attract and retain moisture. In addition the salt content in the mortar will produce a whitish powder of efflorescence, which discolors the brickwork or masonry.

#### ***c. water***

The workability of a mortar increases as the water content of the mix is increased. Water lubricates the mixture. However, increased water content will cause a decrease in strength, produce cracks (shrinkage) and decrease density. Therefore, not only the quality, but equally important the quantity of the water is important for producing a good mortar and brick masonry work.

Almost any natural water that is drinkable and has no pronounced taste or odor can be used as mixing water for making cement mortar. Water suitable for making cement mortar, however, may not be fit for drinking.

**d. Filler**

A substance that is used to fill small holes and cracks, especially in wood and walls

**e. timber**

Timber denotes wood, which is suitable for building or carpentry or various other engineering purposes like for construction of doors, windows, roofs, partitions, beams, posts, cupboards, shelves etc.

Properties of Materials

Physical

Chemical

Mechanical

Specifications of materials.

**Learning unit 2: Apply basic plastering skills**

**2.1. Prepare materials for plastering**

Different types of ingredients

Cement

Sand

**Gypsum compound.**

gypsum plaster is one of the best available on the market. It's easy to use and allows for smooth rendering over plasterboard joints, surface defects and cracks. Gypsum plaster is also excellent for using as a cement surface and an adhesive for the installation of lining walls.

**Stucco putty.**

**Stucco consists of a binder, an aggregate and water.** Traditionally, it is made of cement mixture, in which the cement is combined with water and inert materials such as sand and lime, and will dry to a very hard and dense solid.

Occasionally, acrylics and glass fibres are added to the mixture to improve the strength of stucco. **Or** a material usually made of portland cement, sand, and a small percentage of lime and applied in a plastic state to form a hard covering for exterior walls

Mixing of ingredients

Using proper material (sand, stucco, cement, water) for plastering works.

### **Mixing ratio for plastering works.**

Wall plastering = 1:6

Ceiling plastering = 1:4

External wall plastering = 1:4

Internal wall plastering = 1:5

Repair wall plastering = 1:3

All in {Cement : Sand}

## **2.2. Apply plastering**

### **Techniques**

**Plastering** is the process of covering rough surfaces (of walls, columns, ceiling, and other components of the building) with a coat of plastic mortar to form a smooth and durable surface.

Preparation of the area

#### **(i) Preparation of background**

1. For plastering new surfaces, all masonry joints should be raked to a depth of 10mm for providing key to the plaster.
2. All mortar dropping, and dust should be removed with the help of stiff wire brush.
3. If there are any holes or unlevelled surface, it is levelled before rendering is applied. For plaster having three coats, the depth is bigger than that of 2 coats.
4. The surface should be washed with clean water and kept wet uniformly. The surface is not to be continuously soaked with water so as to cause sliding of mortar before it sets.
5. If plaster is to be applied on old surface, all dirt, oil, paint, etc. should be cleaned off.
6. The surface of the background should be exposed and joints should be properly raked.

The commonly types of mortar used for plastering are:

1. Cement mortar;

2. Lime mortar;
3. Lime-cement mortar.
4. **Lime mortar:** A mixture of lime, sand with water (1:3 to 1:6) (lime: sand) develops strength slowly.
5. **Cement mortar:** A mixture of cement, sand with water (1:3 to 1:9) (cement: sand) workable but too strong for everyday use, only suitable for heavily loaded brickwork or in extremely wet situations.
6. **Cement-lime mortar:** A mixture of cement, lime and sand with water (1:1:6 to 1:2:11) (cement: lime: sand).

The selection of the type of mortar for plastering will depend upon:

1. The availability of binding material;
2. The durability which is required;
3. The finishing which is needed;
4. Atmospheric conditions (either exposed surfaces or interior surfaces)

### **WHY DO WE HAVE TO PLASTER?**

Plastering is done to achieve the following objectives:

- i. To protect the external surfaces against penetration of rainwater and other atmospheric agencies.
- ii. To impart (give) a smooth surface in which dust and dirt cannot lodge.
- iii. To give decorative effects.
- iv. To protect the surfaces of the walls against vermit.
- v. To increase the strength of the structure.
- vi. To hide some defects of workmanship.

### **A good plaster, well done , should fulfill the following requirements:**

- a) It should adhere to the background (wall, column, ceiling, etc), and should remain adhered during all variations in seasons, and other atmospheric conditions.
- b) It should be hard and durable.
- c) It should possess (have) a good workability.
- d) It should be possible to apply it during all weather conditions.
- e) It should be cheap.
- f) It should effectively prevent the penetration of moisture.

Demolition in case of repair

### **Spray water on the Surface**

- 1) Before the first coat can be applied, the surface of the background is swept with the wire brush so that all the dust is removed.

After sweeping, it is watered so that the dry surface of the background will not consume the water contained in the mortar; and causes bad setting. After two or three days the rendering coat is applied it is made corrugated and the second coat is applied.

### **Use of levelling Mar/screeds/dots**

In order to keep the same thickness all along the whole surface,

- i. Screeds are formed on wall surface by fixing dots of 15cmx15cm size.
- ii. Two dots are so formed in vertical line, at a distance of about 2m and are plumbed by means of a plumb bob. A vertical strip of mortar, known as screed is then formed.
- iii. A number of vertical such screeds are formed at suitable spacing. Cement mortar is then applied on the surface between the successive screeds and the surface is properly finished.
- iv. Before rendering hardens, it is suitably worked to provide mechanical keys for the final coat or finishing coat. It is kept wet for at least 2days and then allowed to dry completely.
- v. The final coat (the finishing coat) is then applied. The thickness varies from 2mm to 3mm. Before applying the final coat, the rendering coat is damped evenly. The final coat is applied by the help of wooden float to a true smooth finished surface.
- vi. The finishing coat should be applied starting from the top towards the bottom, and complete in one operation to eliminate joining marks (It has to be fully completed in one day).

#### **☑ Steps of applying plaster mortar**

Fill in the space between the levelled marks

Screeding the cement mortar

Smooth the surface

### **DEFECTS IN PLASTERING**

#### **a) Cracking**

It consists of the formation of small or big cracks or fissures in the plaster work. Cracking results from the following reasons:

- ✓ Imperfect preparation of the background;



- ✓ Structural defects in building;
- ✓ Discontinuity of surface;
- ✓ Movements in the background due to its thermal expansion or rapid drying;
- ✓ Movements in the plaster surface itself; due to expansion or shrinkage;
- ✓ Excessive shrinkage due to application of thick coat;
- ✓ Faulty workmanship.

**b) Efflorescence**

It is the white crystalline substance which appears on the surface. It is due to the presence of salts in materials which make the plaster making materials as well as building materials like bricks, sand, cement etc and even water. This gives a very bad appearance. It affects the adhesion of paint with wall surface. Efflorescence can be removed to some extent by dry brushing and washing the surface repeatedly.

It may also be due to other materials like bricks, sands, cement, etc. which make the wall. This gives a very bad appearance. It affects the adhesion of paint with wall surface.

Efflorescence can be removed to some extent by dry brushing and washing the surface several times.

- c) **Uneven surface** It is obtained due to the poor workmanship.
- d) **Flaking**: It is the formation of very loose mass of plastered surface, due to poor bond between successive coats.
- e) **Peeling**: It is the complete dislocation of some portion of plastered surface, resulting in the formation of a patch. This also results from imperfect bond.
- f) **Popping**: It is the formation of conical hole in the plastered surface due to presence of some particles which expand on setting
- g) **Crazing**: it is the development of some hair cracks in the plastered.
- h) **Rust Stains**: These are sometimes formed when plaster is applied on metal laths
- i) **Blistering of plastered surface**: This is the formation of small patches of plaster swelling out beyond the plastered surface, arising out of late slaking of lime particles in the plaster.

## TERMINOLOGY USED IN PLASTERING WORKS

1. **Background**: it is the surface to which the first coat of plaster is applied.
2. **Cracking**: it is the development of one or more fissures in the plaster due to movements in the background, or surrounding structures.

3. **Crazing:** this is the development of hair cracks, usually in an irregular pattern, over the finished surface.
4. **Dado:** this is the lower part of the plastered wall. It has to be well treated to give better resistance against the attack of water flowing on the floor.
5. **Dots:** these are small projections of plaster, laid on the background, for fixing the screeds. They are reference points for plastering. Their size may be 15cm×15cm.
6. **Dubbing coat:** it is a coat applied to the background to fill up hollow spaces in the solid background, before applying the main body of the plaster.
7. **Under-coat:** they are the coats of plaster applied under the finishing coat.
8. **Finishing coat:** it is the final coat of plaster. Such a coat is also known as **setting coat** or **skimming coat**.
9. **Flaking:** this is the process of cutting off patches of plaster of previous coats, due to lack of adhesion with the under-coat.
10. **Gauging:** it is the process of mixing various constituents of plaster.
11. **Grounds:** these are wooden strips fixed to the background to which primary finishing may be secured.
12. **Hacking:** it is the process of roughening the background to provide suitable bond or key for plastering.
13. **Keys:** they are openings or corrugations on the background or surfaces of the under coats, to which plaster will form mechanical bond.

The background over which plaster is to be done, depend upon:

- The type of wall construction (such as coarse rubble masonry, brick masonry, cement block work, etc)
- The nature of surface.
- The atmospheric or climatic conditions.
- The level of protection needed.

Different thicknesses of plaster are required for different types of backgrounds. Plastering is therefore applied in **one, two, or three coats**. Plaster in one coat is applied only for inferior works. Generally, lime plaster is applied in three coats.

Cement plaster is applied either in two or three coats:

<b>NATURE OF BACKGROUND</b>	<b>NUMBER OF COATS</b>
Stone works	2 coats or three coats
Brick works	2 coats or three coats
Concrete cast in situ	2 coats or one coat
Concrete blocks	2 coats or three coats
Slab	2 coats or one coat