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**DEGREE : B TECH CIVIL**

**SUBJECT : MATERIALS AND METHOD OF CONSTRUCTION**

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**Final examination spring 2020**

**Q1(A) Give the Characteristics of Earth used for manufacturing of bricks.?**

**(ans)**. A brick is a type of block used to make walls, pavements and other elements in masonry construction. Traditionally, the term brick referred to a unit composed of fired clay but it is now used to denote rectangular units made of clay-bearing soil, sand, and lime, or concrete materials. Bricks can be joined together using mortar, adhesives or by interlocking them. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic categories of bricks are fired and non-fired bricks.

Methods of manufacture

Three basic types of brick are un-fired, fired, and chemically set bricks. Each type is manufactured differently.

Mudbrick

Unfired bricks, also known as mudbrick, are made from a wet, clay-containing soil mixed with straw or similar binders. They are air-dried until ready for use.

A mudbrick or mud-brick is an air-dried brick, made of a mixture of loam, mud, sand and water mixed with a binding material such as rice husks or straw. Mudbricks are known from 9000 BCE, though since 4000 BC, bricks have also been fired, to increase their strength and durability.

Fired brick

Fired bricks are burned in a kiln which makes them durable. Modern, fired, clay bricks are formed in one of three processes – soft mud, dry press, or extruded. Depending on the country, either the extruded or soft mud method is the most common, since they are the most economical.

Normally, bricks contain the following ingredients:

1. Silica (sand) – 50% to 60% by weight

2. Alumina (clay) – 20% to 30% by weight

3. Lime – 2 to 5% by weight

4. Iron oxide – ≤ 7% by weight

5. Magnesia – less than 1% by weight

Shaping methods

Three main methods are used for shaping the raw materials into bricks to be fired:

Molded bricks – These bricks start with raw clay, preferably in a mix with 25–30% sand to reduce shrinkage. The clay is first ground and mixed with water to the desired consistency. The clay is then pressed into steel moulds with a hydraulic press. The shaped clay is then fired ("burned") at 900–1000 °C to achieve strength.

Dry-pressed bricks – The dry-press method is similar to the soft-mud moulded method, but starts with a much thicker clay mix, so it forms more accurate, sharper-edged bricks. The greater force in pressing and the longer burn make this method more expensive.

Extruded bricks – For extruded bricks the clay is mixed with 10–15% water (stiff extrusion) or 20–25% water (soft extrusion) in a pugmill . This mixture is forced through a die to create a long cable of material of the desired width and depth. This mass is then cut into bricks of the desired length by a wall of wires. Most structural bricks are made by this method as it produces hard, dense bricks, and suitable dies can produce perforations as well. The introduction of such holes reduces the volume of clay needed, and hence the cost. Hollow bricks are lighter and easier to handle, and have different thermal properties from solid bricks. The cut bricks are hardened by drying for 20 to 40 hours at 50 to 150 °C before being fired. The heat for drying is often waste heat from the kiln.

Optimal dimension , characteristic, and strength

For efficient handling and laying, bricks must be small enough and light enough to be picked up by the bricklayer using one hand (leaving the other hand free for the trowel). Bricks are usually laid flat, and as a result, the effective limit on the width of a brick is set by the distance which can conveniently be spanned between the thumb and fingers of one hand, normally about 100 mm (4 in). In most cases, the length of a brick is twice its width plus the width of a mortar joint, about 200 mm (8 in) or slightly more. This allows bricks to be laid bonded in a structure which increases stability and strength (for an example, see the illustration of bricks laid in English bond, at the head of this article). The wall is built using alternating courses of stretchers, bricks laid longways, and headers, bricks laid crossways. The headers tie the wall together over its width. In fact, this wall is built in a variation of English bond called English cross bond where the successive layers of stretchers are displaced horizontally from each other by half a brick length. In true English bond, the perpendicular lines of the stretcher courses are in line with each other.

A bigger brick makes for a thicker (and thus more insulating) wall. Historically, this meant that bigger bricks were necessary in colder climates (see for instance the slightly larger size of the Russian brick in table below), while a smaller brick was adequate, and more economical, in warmer regions. A notable illustration of this correlation is the Green Gate in Gdansk; built in 1571 of imported Dutch brick, too small for the colder climate of Gdansk, it was notorious for being a chilly and drafty residence. Nowadays this is no longer an issue, as modern walls typically incorporate specialised insulation materials.

The correct brick for a job can be selected from a choice of colour, surface texture, density, weight, absorption, and pore structure, thermal characteristics, thermal and moisture movement, and fire resistance.

Face brick ("house brick") sizes, (alphabetical order)

Standard Imperial Metric

Australia

9 × 4⅓ × 3 in

230 × 110 × 76 mm

Denmark

9 × 4¼ × 2¼ in 228 × 108 × 54 mm

Germany

9 × 4¼ × 2¾ in 240 × 115 × 71 mm

India

9 × 4¼ × 2¾ in 228 × 107 × 69 mm

Romania

9 × 4¼ × 2½ in 240 × 115 × 63 mm

Russia

10 × 4¾ × 2½ in 250 × 120 × 65 mm

South Africa

8¾ × 4 × 3 in 222 × 106 × 73 mm

Sweden

10 × 4¾ × 2½ in 250 × 120 × 62 mm

United Kingdom

8½ × 4 × 2½ in 215 × 102.5 × 65 mm

United States

7⅝ × 3⅝ × 2¼ in 194 × 92 × 57 mm

Limitation Starting in the 20th century, the use of brickwork declined in some areas due to concerns with earthquakes. Earthquakes such as the San Francisco earthquake of 1906 and the 1933 Long Beach earthquake revealed the weaknesses of unreinforced brick masonry in earthquake-prone areas. During seismic events, the mortar cracks and crumbles, and the bricks are no longer held together. Brick masonry with steel reinforcement, which helps hold the masonry together during earthquakes, was used to replace many of the unreinforced masonry buildings. Retrofitting older unreinforced masonry structures has been mandated in many jurisdictions.

**Q1(B) Suggest a good building stone of your area and give the technical reason for its using.**

(ans). **Good Building Stones**

Every building stone which is used for construction, cannot satisfy all the ideal requirements. For example, when the stone satisfies the requirement of strength and durability, it may not do the same with other necessities such as ease of dressing. Hence it is the job of the site engineer to look into the properties which are required for the specific work and select the stone accordingly.

Construction Aggregate Properties

A good building stone should have the following qualities:

Appearance:

Building Stones used for the face work of the building should have fine, compact texture. Light colored stone is usually preferred as dark colors are prone to fade out with time. They should be free from clay holes, bands or spots of color.

Structure:

A stone when broken, should not be dull in appearance and should show uniformity of texture. It should be free from cavities, cracks, and patches of loose or soft material. Stratifications, which are usually found in sedimentary rocks should not be visible to naked eye.

Strength:

Stones used in construction should be strong and durable to withstand the disintegrating action of weather. Generally the stones can withstand the forces they encounter in usual constructions but in case of constructions where the forces encountered are unusual, they should be tested for its strength. Stones with compact fine crystalline texture are stronger. Compressive strength of building stones in practice, range between 60 to 200 N/mm2.

Specific gravity:

The specific gravity of Building stone is directly proportional to its weight and strength. Hence the stones having higher specific gravity should not be used for dams, retaining walls, docks and harbours. Specific gravity of a good building stone lies between 2.4 to 2.8.

Hardness:

When stones are utilized for floors, pavements, aprons of bridges and weirs of rivers, the stones are subjected to abrasive forces which are caused by the wear and friction. Hence the stones which are to be used in such places should be tested for hardness.

Toughness:

It is the measure of impact that a stone can withstand. When the stones are supposed to undergo vibrations of machinery and moving loads, they should be tough.

Porosity and Absorption:

The porous building stones are not suitable in construction especially for exposed surfaces of structures. The rain water which comes down carry some acidic gases forming light acids which gets soaked on the surface. Acids react with the constituents of stones causing them to crumble. In cold regions water freezes in the pores of stones. This water causes the disintegration of stones because of its increase in volume on freezing.

Stones should be tested for porosity and porous stones should be used only at places where they don’t encounter frost, rain or moisture in any form. Water absorption is directly proportional to the porosity of the rock. The more porous the rock is, the more water it will absorb and leads to the damaging of stone.

The types of some of the stones and their maximum limit of water absorption (%) is as follows:

• Sandstone : 10

• Limestone : 10

• Granite : 1

• Trap : 6

• Shale : 10

• Gneiss : 1

• Slate : 1

• Quartzite : 3

Seasoning:

All freshly quarried stones contain a certain amount of moisture known as quarry sap, which makes them soft and easier to work upon .Good stones should be free from quarry sap. They are allowed to get rid of quarry sap by the action of nature. This process of removing quarry sap is called seasoning. A period of 6-12 months is generally enough for proper seasoning.

Weathering:

It is the extent to which the face of a stone resists the action of weather. Stones with good weathering properties only should be used in the construction of important buildings.

Workability:

Stones are said to be workable if the wok which is involved in their cutting, dressing and shaping is considered as economical and easy to conduct. Know the Current House construction cost

Fire Resistance:

Building Stones should be free from calcium carbonate, oxides of iron, and minerals having different coefficients of thermal expansion. Igneous rock undergo major disintegration because of quartz which disintegrates into small particles at a temperature of about 575 oC. Limestone, however, can withstand a little higher temperature; i.e. up to 800 oC after which they disintegrate.

**Q2(A) Give the uses of Copper, Lead, Tin, Zinc, Aluminium in different civil engineering works.**

**What precautions must be observed while blasting in quarrying.**

**Answer :-**

**Durilling blasting :-**

Durilling blasting is the contrilled use of explosives and other methods such as as pressure blasting pyrotechnics,to brak rock for excavation. It is practicesmost often in mining, quarrying and civil engineering such as dam, tunnel or road construction. The result of rock blasting is often known as a rock cut

Drilling and blasting currently utilizes many different varieties of explosives wih different compostions and performance properties. Highe velocity explosives are used for relatively hard rock in other to shatter and break the rock, while low velocity explosives are used in soft rocks to generate more gas pressure and a greather heaving effect. For instance, an early 29 th cenury blasting manual compared the effects of black powder to that of a wedge, and dynamite to that of a hammer. The most commonly used explosives in mining today are ANFO basesd blends due to lower cost than dynsmite.  
Before the advent of tunnel boring machines TBMs, drilling and blasting was the only economical way of excavating long tunnels though hard rock, where digging is bot possible. Even today, the method is still used in the construction of tunnels, such as in the construction of the lotschberg base tunnel. The decision whether to construct a tunnel using a TBM or using a drill and blast method includes a number of factors. Tunnel length is a key issue that needs to be addressed because large TBMs for a rock tunnel have a high capital cost, but because they are usally quicker than a drill and blast tunnel the price pe metre of tunnel is lower. This means that shorter tunnels tend to be less economical to construct with a TBM and are therefore usually constructed by drill and blast. Managing ground conditions can also have a significant effect on the choice with different method suited to different hazards in the ground.

**Blasling precautions you must take**

Explosives provide the energy to break and lossen the rock necessary for processing. To effectively blast rock, a tremendous amount of energy must be released in a very short period of time. If not done correctly, this energy release can cause damage, injury of death

The cellenge in blasting is to control the energy to break and move the rock without causing flyrock, high vibration or airblast.

**Proper planning**

When blasting, there are at least major safety concerns. One is premature detonation. The other is flyrock

Premature denotaion involves an unplanned detonation during the loading or typing-in- procedures, or while awaiting scheduled firing. Explosives require heat or shock energy to begin the detonation process . Therefore,preventing contacts with these sources of energy is of utmost importance.

Examples of unwanted contact could include explosives being run over by equipment, being exposed to a fire on the blast pattern, being exposed to lightning strikes or having a drill intersect a loaded hole. To prevent such hazards consider the following:

Using cones or berms, demarcate the blast site(the area where holes are loaded or in the process of being loaded)

Within the blast site, have only the personnel and equipment necessary to load the blast

Complete drilling prior to commencement of loading,or have the drill at a distance where it cannot possibly intersect a loaded hole. Also, consider drills have been prone to fires when hydraulic lines brust onto a hot engine or compressor.

**Q2(B) Compare Brick masonry and Stone masonry?**

Answer

Comparison of brick masonry and store masonry, brick masonry, stone masonry,

Masonry is the art of the construction in brick or stone. Expect in dry masonry some mortar is usrd to bind the brick or block of stones, with each other. There are in general two type of masonry. Brick masonry and stone masonry. Brick masonry is that in which bricks are used while in stone masonry, stone blocks are used

**Comparison of brick masonry and stone masonry :**

1. Generally brick masonry is cheaper than stone masonry and can be easily constructed
2. The minimun, thikness of wall in stone masonry can be 35cm whereas, in brick masonry, wall of 10cm thickness can be constructed.
3. The brick masonry construction proceeds very quikly wherease the stone masonry construction proceeds very slowly, as the brick are handy whereas stone are not .
4. Skilled masons are required for stone masonry construction, whereas un skilled lamen can do the brick masonry work.
5. Brick masonry requires less mortar whereas stone masonry requires more mortar which cannot be easily estimated.
6. Stone masonry is stronger and more durable brick masonry.
7. It is not essential to plaster the stone masonry walls whereas brick walls have to be plastered or painted, wjen exposed to the open atmosphere.
8. Brick are of an absorbent nature and no absorbing moisture make the building, dam, but stones are less adsorbent, and hence stone masonry walls ir buildings and more damp proof.
9. Brick masonry work cannot be allowed to come in cantact with urine, sewage etc, with protecting them, whereas this is not the case with stone masonry.
10. Brick masonry is more fire- resistant than stone masonry.
11. Good ornamental work can be cheaply and easoly done in plaster in case of brick masonry, but it is not possible in stone masonry.
12. Being uniform and regular in shape, proper bond can be easily abtained in case of brick as compared with stones. Similarly, ontuse and acute angle joints can be easilt provided with brick in masonry than stone masonry.
13. Brick absorbs less quantity of heat than stone, therefore in not climates, during nights, stone walls emit mere qusntity of heat and make sitting in the roon uncomfortable.

The common materials of masonry construction are brick, duilding stone sush as marbal, granite, amd limestone,cast stone, concrete block, glass block, and adobe. Masomry id generally who durable masornyis called a mason or bricklayer.

Generally brick masonry is cheape than stone masonry and can be easily constructed… brick masonry requires less mortar whereas stone masonry reqiuredmore mortar which cannot be easily estimated. Stone masonry is stronger more durable beick masonry.

However, natural stone, as a mateial,tends to be nore expensive than brick a it is slightly harder to find …. on average ntural stone is probably still slightly more expensive that brick despite being cheaper to install. However , manufactured stone is probably around the same price or slightly cheaper than brick.

While both materials are

Durable, stone is stronger than brick. But brick is less expensive than stone. Both can withstand the elements,including strong winds, hot sum, and sub-freezing temperature.

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Brick Masonry** | **Stone Masonry** |
| 1 | Uniform in shape and size. | Not of uniform shape and size. |
| 2 | Light in weight. | Heavy. |
| 3 | Does not require any dressing. | Requires dressing. |
| 4 | Not easily available. | Available easily. |
| 5 | Laying is easy. | Laying is difficult. |
| 6 | Mortar joints are thin. | Mortar joints are thick. |
| 7 | Less watertight. | More watertight. |
| 8 | Have better fire resistance. | Fire resistance is poor. |
| 9 | The cost of construction is less. | The cost of construction is more. |
| 10 | Not much strong. | Stronger. |

**Q3(B) Under what Circumstances would you prefer pointing to plastering?**

pointing, plastering, bonding. • It is the art of finishing the mortar joints in exposed brick or stone masonry with suitable cement or lime mortar, in order to protect the joints from weather effects and also to improve the appearance of building structure

Pointing, in building maintenance, the technique of repairing mortar joints between bricks or other masonry elements. When aging mortar joints crack and disintegrate, the defective mortar is removed by hand or power tool and replaced with fresh mortar, preferably of the same composition as the original.

Use a dry-ish building sand, plastering sand or, if so desired, a Kiln Dried Jointing sand. Some installers like to use a coarser or sharp sand, but this can result in a rough-looking finish when used for dry grouting.

The main difference in the two practices is that plastering refers to coating the interior walls, whilst rendering is the coating of exterior walls. ... Nonetheless plaster and render are both made from the same building materials including, cement, sand, water and lime gypsum.

n many cultures, including ours, pointing at other people is considered rude because it's associated with blame allocation ('to point the finger at…'). Also, by pointing at someone, you automatically, and without their consent, make them an object of scrutiny.

1. 1. Plastering and Pointing
2. [2.](https://image.slidesharecdn.com/plasteringandpointing-171219153720/95/plastering-and-pointing-2-638.jpg?cb=1515228596" \t "_blank" \o )Plastering • Process of covering rough surfaces of walls, columns, ceilings and other building components with thin coat of plastic mortars to form a smooth durable surface
3. [3.](https://image.slidesharecdn.com/plasteringandpointing-171219153720/95/plastering-and-pointing-3-638.jpg?cb=1515228596" \t "_blank" \o )Objects of plastering • To protect external surfaces against penetration of rain water and other atmospheric agencies • To give smooth surface in which dust and dirt cannot lodge • To give decorative effect • To protect surfaces against vermit • To conceal inferior materials or defective workmanship
4. [4.](https://image.slidesharecdn.com/plasteringandpointing-171219153720/95/plastering-and-pointing-4-638.jpg?cb=1515228596" \t "_blank" \o )TYPES OF MORTAR FOR PLASTERING • LIME MORTAR • may be either fat lime or hydraulic lime • Fat lime yields good putty after slaking; preferred more • Hydraulic lime contains particles which slake very slowly; slow slaking may cause blisters • Mix proportion(lime: sand)- 1:3 to 1:4 for fat lime - 1:2 for hydraulic lime • Addition of “gugal” can improve the binding properties of lime mortar • Mixing of chopped hemp can improve adhesive and tensile properties of lime mortar
5. [5.](https://image.slidesharecdn.com/plasteringandpointing-171219153720/95/plastering-and-pointing-5-638.jpg?cb=1515228596" \t "_blank" \o )• CEMENT MORTAR • Being non-absorbant, it is best for external plastering work • Preferred in damp rooms and damp climates • Stronger than lime mortar • Does not possess sufficient plasticity • Mix proportion (cement: sand)- 1:4 to 1:6 • Mortar should be used before initial setting takes place • Sand used should be clean, coarse and angular • LIME-CEMENT MORTAR • Contains properties of both lime mortar as well as cement mortar • Addition of lime imparts plasticity resulting in smooth plastered surface •

**Q4(A) What is meant by seasoning of timber? Briefly describe the various methods of seasoning.**

**Seasoning :**

The process of remonal of moistur content from wood, so as to make it useful for constructuon and other uses, is called drying of wood oe seasoning of wood. This reduces the chances of decay,improves laod bearing properties, reduces weight, and exhibits more favourable properties like thermal and electrical insultion,glue adhesive capacity and easy preseravtion treatment etc. Seasoning of timber is a procress by which moisture content in a freshly cut tree is reduced to a suitable level, by doing so the durability of timber is increased.

**Wood seasoning can have the following purposes.**

1. **Artificial method or kiln seasoning**

Akiln drying of lumber is perhaps the most effective and economicalmethod available. Drying rates in akiln can be carefully controlled and defect losses reduced to a minimum length of drying time is also grathy reduced and is predictable so that dry lumber invebtories can aften be reduced. Where staining is problem, kiln drying is often the only reasonable method that can be used unless chemical dips are employed, rtifical or kiln.

1. **Method of Air Seasoning/ Natural Seasoning:**

The basic peinciple is to stack the timber so that plenty of air can circulate around each piece. The timber is stacked with wide spaces between each piece horizontallly, amd with strips of wood between each lyer ensuring that there is a vertical separation too. Air can then circulate around and through the stack, to slowly remove moisture. In some cases, weights can be placed on top of the stacks to prevent warping of the timber as it dries.

Moisture loss from the side of the wood is at about the right rate not ro cause collapse of the cells, but near the ends of the wood, the moisture loss can prove to be too fast. Often the ends are wrapped or painted to slow the moisture loss from the end grain.while litter additional energ needs to be supplied for this type of seasoning, the stacks of timber require a lot of land, represend a potential fire hazard, and the product is not able to be sold a considerable time.

1. **Chemical seasonong and preservative of wood**

Preservatives increase the resistance of wood to decay and increase its useful life.

**There are 3 main clases of preservatives**

1. Oily substances insoluble in water.
2. Water soluble salts.
3. Salts carried in volatile solvent other than wate.
4. **Microwave seasoning**

Microwave seasoning uses pulsed energy directed into timbers to drive out moisture in a maner that will not cause seasoning degrade. This method also provides advantages. Such as high speed and high qualilty and is wel suiled for seasoning lumber,blocks, venner, chips, paper and wood bsed compposite materials.

Area in the in the wood with the most moisture absorb the most energy resulting in even temperature during process and a uniform moisture content. There factors enhance quality and reduce timber cheaking and warping.

Q4(B)Suggest the remedial measures for the failure of foundation.

**Answer**

Most commonly **foundation failure** is caused by the movement of expansive and highly plastic soils beneath different sections of the **foundation** footings. This movement of soil can be in the form of shrinkage, which causes settlement, or expansion, which causes heave. ... When moisture levels are high, soils swel.

The failured of foundation due to unequal settlement can be checked by. Resting the foundation on rigid strate, such as rock or hard moorum, proper design of the base of footing, so that it can resist cracking, limiting the pressure in the soil, and, avoidinf eccentric loading.

Evaportion hot and dry condition may cause the soil to pull away from the foundation ..

Transpiration.

Plunbing leaks.

Drainage.

Poor building site preparation.

Poor ground preparation.

Poor soil conditions.

**Causes of Failures of Foundation and Remedial** **:**

Masonry should be raised uniformly over the whole area. A slow progress of masonry work makes stronger joints and has more uniform settlement.

**Unequal Settlement of the Sub-soil**

Unequal distribution of the weight of the structure on the foundations due to eccentricity of loads. In continuous wall foundations reinforcement should be provided whenever an abrupt change in magnitude of load or variation in ground support may occur.

**Horizontal Movement of the Earth Adjoining the Structure**

This is effective in the cases of clay soils aid black-cotton soils.  Such soils become soft and swall when wet loosing their bearing power considerably and shrink and crack when dry.

**Atmospheric Action**

Rain and the sun are the main agents for atmospheric action with the change of seasons. Rise and fall of the subsoil water level, increasing or decreasing the moisture content which is especially effective when the underground water is near the surface, or in damp soils overlying a layer of porous material like sand etc. causes cracks due to expansion or shrinkage of sub soil.  Soakage of the rain water in the sub-soil also produces a number of changes as above and sometimes bring in salts which react chemically on the lime and

bricks m the foundations and cause them to disintegrate.  Underground open drains should be provided to drain out the excess water when the subsoil water level rises. Deep foundations with sides (of the trenches) well filled and consolidated with good slope away from the walls given to the ground surface will help against rains. A plinth protection of about 60 to 90 cm width with concrete or flat brick flooring will give further protection. Cement or hydraulic lime should be used with stone or over-burnt bricks upto the plinth level in damp locations.

Unequal settlement of sub soil.

Unequal settlement of masonry.

Sub-soil moisture movement.

Lateral pressure on the wall.

Lateral movement of sub-soil this is applicable to very soft soil which are liable to move out or sequeeze out laterally under.

Vertical loads, specially at locations where the ground is sloping .

Purpose of Foundation :

To distribute the load of the structure over a large bearing area so as to bring intensity of loading within the safe bearing capacity of the soil lying underneath.

**Q5(A)What sort of method will you suggest for preventing dampness in building at your home town. Explain with a valid reason.**

Dampness is building may accur due to bad design, faulty construction and use of poor quality of materils. Dampness not only affects the life of the buliding but also creates unhygienic conditions of the important items of work in the construction of building.

The treatment given tp prevent leakage of water from roof is generally termed as water proofing whereas the treatment given to keep the walls, floors and basement dry is termed as damp proofing.

**Defects caused by dampness in buliding.**

The verious defects caused by dampness to building may be summarized as.

1. it causes effloresence which may ultimately result in disinteragration brick, stone,tiles etc.
2. It may result in softening and crumbling of plaster
3. It may cause bleaching and flaking of paint with formation of coloured patches.
4. It may result in the warping, buckling and rotting of timber
5. It may lead to the corrosion of metals.

# **DAMPNESS PREVENTION METHODS:**

The following are the precautions to be taken to prevent dampness in buildings, before applying the various techniques.

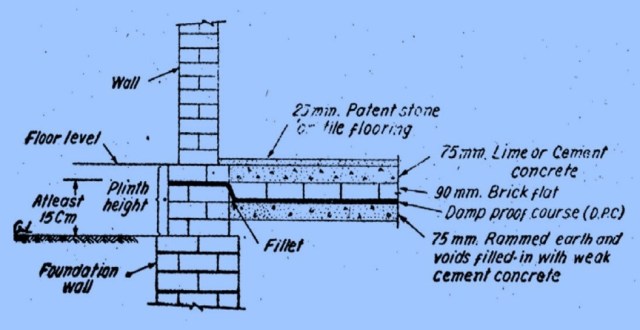
1. The site should be located on high ground and well-drained soil to safe guard against foundation dampness
2. All the exposed walls should be of sufficient thickness to safeguard against rain protection (**minimum 30 cm**)
3. Bricks of superior quality free from defects should be used
4. Good quality cement mortar (1:3) should be used to produce definite pattern and perfect bond in the building
5. Cornices and string courses should be provided to repel rain water away from the walls
6. All the exposed surfaces like top of walls, compound walls etc. should be covered with water proofing cement plaster
7. Cavity walls are more reliable than solid walls in preventing the dampness

# TECHNIQUES:

1. Use of damp proof courses
2. Water proof or damp proof treatments
3. Integral damp proofing treatment
4. Cavity walls or hallow walls
5. Guniting or shot concrete or shotcrete
6. Pressure grouting or cementation

# 1. USE OF DAMP-PROOF COURSES (D.P.C.)

These are layers or membranes of water repellent materials such as bituminous felts, mastic asphalt, plastic sheets, cement concrete, mortar, metal sheets, stones etc. which are interposed in the building structure at all locations wherever water entry is anticipated or suspected. The best location or position of D.P.C. in the case of building without basement lies at plinth level or structures without any plinth level, it should be laid at least 15cm above ground level. The damp proof course is provided horizontally and vertically in floors, walls etc.

DPC above ground level

# 2. WATER PROOF SURFACE TREATMENTS:

The surface treatment consists in filing up the pores of the material exposed to moisture by providing a thin film of water repellent material over the surface (internal / external). External treatment is effective in preventing dampness.

Many surface treatments, like pointing, plastering, painting, distempering etc. are given to the exposed surfaces and also to the internal surface. The most commonly used treatment to protect the walls against dampness is lime cement plaster (1:6) (1-cement, 6-lime) mix proportion. Generally employed as water proofing agent in surface treatments are sodium or potassium silicate. Aluminium or zinc sulphate, Barium Hydroxide and magnesium sulphate in alternate applications. Soft soap and alum also in alternate applications, unie and unseed oil; coal tar, bitumen, waxes and fats; resins and gums Waxes and fats are not suitable in tropics as they melt with rise in temperatures

# 3. INTEGRAL DAMP-PROOFING TREATMENTS:

The integral treatment consists of adding certain compounds to the concrete or mortar during the process of mixing, which when used in construction acts as barriers to moisture penetration under different principles

i) Compounds like chalk, talc, fallers earth etc. have mechanical action principle (i.e.,) they fill the pores present in the concrete or mortar and make them dense and water proof

ii) Compounds like denser and water proof sulphates, calcium chlorides etc. work on chemical action principle (i.e.) they react chemically and fill the pores to act as water-resistant

iii) The compounds like soaps, petroleum, oils fatty acids compounds such as sodium ammonium etc. work on the repulsion principle i.e., they are used as admixture in concrete to react with it and become water repellent

# 4. CAVITY WALLS OR HALLOW WALLS:

A cavity wall consists of two parallel walls or leaves or skins of masonry separated by a continuous air space or cavity. The provision of continuous cavity in the wall per effectively prevent the transmission or percolation of dampness from outer walls or leaf to inner wall or leaf. The following are the advantages of cavity wall.

(i) As there is no contact between outer and inner walls of cavity wall, possibility of moisture penetration is reduced to a minimum.

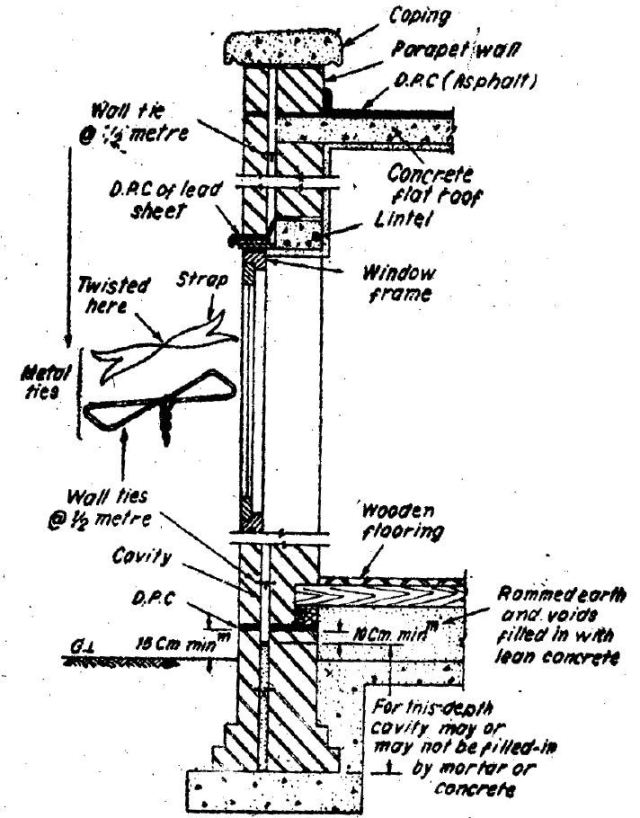
(ii) A cavity wall prevents the transmission of heat through wall.

(iii) A cavity wall offer good insulation against sound.

(iv) The cavity wall tends to reduce the nuisance of efflorescence.

(v) The cavity wall also provides benefits such as economy, better comfort and hygienic conditions in buildings

The cavity wall construction and D.P.C. details for flat roofs are as shown in fig below.

CAVITY WALL CONSTRUCTION TO PREVENT DAMPNESS

# 5. GUNITING: (OR SHOTCRETE):

The technique of guniting consists in forming an imperious layer of rich cement mortar (1:3) or fine aggregate mix for water proofing over the exposed concrete surface or over the pipes, cisterns etc. for resisting the water pressure. By this technique, an impervious layer of high compressive strength (600 to 700 kg/cm2) is obtained and hence this is also very useful for reconditioning or repairing old concrete works

# 6. PRESSURE GROUTING OR (CEMENTATION).

The mixture of cement, sand and water under pressure into the cracks, voids or fissures present in the structural component or the ground. In general, the foundations are given this treatment to avoid the moisture penetration. This technique also used for repairing structures, consolidating ground to improve bearing capacity, forming water cut-offs to prevent seepage etc.

**Q5(B)** **Explain the different methods of fastening with rop**e.

Metal roofs have gained much traction in recent years, as more and more homeowners have become aware of metal roofs' incredible attributes. From strength, durability, to overall energy efficiency, the benefits of metal roofs simply can't be denied. But those who have recently decided to upgrade to a metal roof still have some key decisions to make.

One of the most important of these decisions has to do with the method used to attach your new metal roof to the top of your home. Three main fastening styles exist today, each with its own unique set of benefits. This article takes a closer look at each of these three methods of fastening a metal roof.

### 1. Exposed Fasteners

The majority of metal roofs currently in use today hold themselves in place by means of mechanical fasteners - usually corrosion-resistant bolts or screws that anchor the roof in the underlying decking material. Fasteners generally fall into one of two categories: exposed or concealed.

As you can probably guess, exposed fasteners physically penetrate the top of the roofing panels. Take a trip up onto an exposed fastener metal roof and you can see rows upon rows of screw heads protruding from the panels. While some people consider exposed fasteners aesthetically displeasing, others value its many advantages.

Exposed fasteners tend to be much easier to attach - a fact that greatly cuts down on both installation time and the overall cost of the roof. More intrepid homeowners also prefer the do-it-yourself nature of exposed fasteners, as this method can be installed even by those with relatively limited metal roofing experience.

Exposed fasteners have drawbacks as well. For one thing, the fasteners experience more wear and tear, given their exposure to the elements. This exposure increases the threat of corrosion. Exposed fasteners also increase the risk of leaks, since there must be holes that pass through the panels. If fasteners become excessively damaged, water may find a way to penetrate beneath the roof.

### 2. Concealed Fasteners (Standing Seam Roof)

Manufacturers and contractors usually refer to concealed fastener systems as standing seam roofs. Unlike an exposed fastener roof, a standing seam roof does not have fasteners that pass through the metal panels themselves. Instead, contractors use fasteners to attach special clips to the roof deck.

The metal roofing panels then attach to these clips - and to each other - in such a way that the surface of the roof remains completely smooth. This type of system greatly reduces the chances of both fastener corrosion and roof leaks. In addition, the sleek profile of a sanding seam roof adds a degree of curb appeal far beyond that of exposed fastener roofs.

That said, standing seam roofs tend to come with significantly higher price tags. This increased cost reflects the greater degree of difficulty involved in attaching the panels. Of course, since standing seam roofs experience fewer problems as time goes on, they often come with longer warranty periods.

### 3. Concealed Adhesive

Recently, a new type of metal roofing system has entered the market - one that forgoes fasteners altogether. Instead, heavy-duty adhesives hold the metal panels tightly to the roof deck. Like standing seam roofs, concealed adhesive roofs present a smooth and sleek outer surface - one free from penetrations or unsightly screw heads.

While the idea of gluing your roof in place may not fill you with confidence, concealed adhesive roofs have been proven to hold up to the some of the most brutal conditions. In fact, certain varieties of concealed adhesive roofs have managed to meet the state of Florida's stringent requirements, passing high velocity hurricane zone tests without problem.

We will also explore recommended roofing materials for the common roof types.

* Gable.
* Hip.
* Mansard.
* Gambrel.
* Flat.
* Skillion.
* Jerkinhead.
* Butterfly.