

TED(15)- 2011

**THIRD SEMESTER DIPLOMA EXAMINATION IN CIVIL
ENGINEERING**

CONSTRUCTION MATERIALS AND ENGINEERING

(OCTOBER 2016)

PART -A

1) Distinguish Stratified and Unstratified Rocks?

i) Stratified Rocks:

These rocks are having layered structure. They possess planes of stratification or cleavage. They can be easily split along these planes. Sand stones, lime stones, slate etc. are the examples of this class of stones.

(ii) Unstratified Rocks:

These rocks are not stratified. They possess crystalline and compact grains. They cannot be split in to thin slab. Granite, trap, marble etc. are the examples of this type of rocks.

2) Write the objectives of preservation of timber?

- a) Prolong its life
- b) Increase its durability

3) Distinguish asphalt and bitumen?

A bitumen-sealed road has a layer of bitumen sprayed and then covered with an aggregate. This is then repeated to give a two-coat seal.

Asphalt is produced in a plant that heats, dries and mixes aggregate, bitumen and sand into a composite mix. It is then applied through a paving machine on site as a solid material at a nominated or required thickness, relative to the end use. Asphalt results in a smoother and more durable surface than a bitumen-sealed road.

4) Define prestressing in concrete

Prestressing is the introduction of a compressive force to the concrete to counteract the stresses that will result from an applied load. There are two methods of introducing prestressing to a concrete, namely pre tensioning and post tensioning. Pre tensioning happens before the casting of the concrete.

5) Write two examples of deep foundation

PART-B

II) 1. Write the constituents of ordinary Portland cement

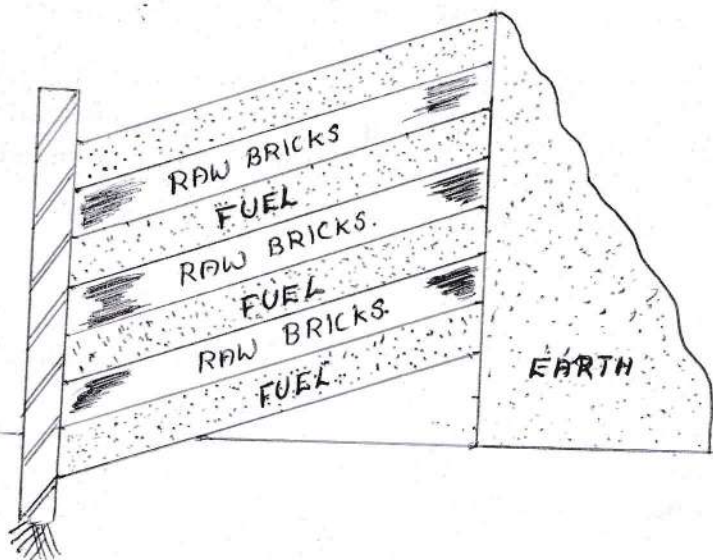
- Lime: it is the major ingredient of cement. Its proportion should carefully maintained. It make the cement sound
- Silica; it also provides strength to the cement. silica in excess causes the cement to set slowly
- Alumina: it provides quick setting quality to the cement. alumina in excess weakens the strength of the cement
- Iron oxide: it provide red colour , hardness and strength to the cement
- Magnesium oxide: it provide colour and hardness to the cement

2. Describe the process of burning of bricks in clamps

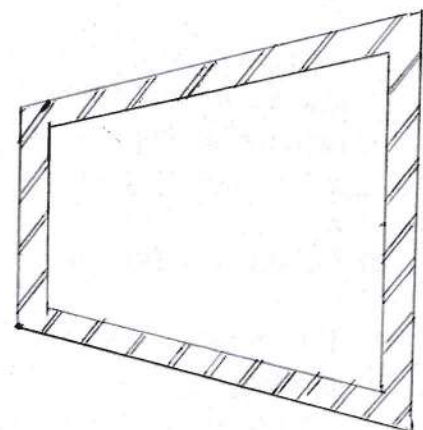
It is a temporary structure in which bricks are burned once at time. It consists of a sloped surface generally trapezoidal shape. Rectangular and circular shapes are also in practice. The shorter end is kept about 300mm below the ground level while the wider end is raised slightly above the ground by earth filling

A layer of fuel consisting rice husk, firewood or coal dust is laid over the surface of clamp. The layer may be about 750mm thick .over these 5 layers of bricks of about 5 layers are laid on edges. Small gap are left in between them while arranging the bricks. Again a fuel layer of lesser thickness is placed. These manner alternate layers of fuel and bricks are laid. The thickness of fuel layer goes on decreasing towards the top.

The clamp is fired at bottom most of fuel. Then the bricks are allowed to burn and cool itself.



SECTIONAL ELEVATION



PLAN

3. Write the objectives of painting

- It should cover the surface and should have hiding power
- It should have good workability
- It should form a thin uniform film over the surface to be painted
- It should dry within short time
- There should not be any cracks after the painting
- It should produce a washable film

4. List the properties and uses of fibre glass

Properties:

- It is very light in weight
- It is fibrous in structure
- It is quite durable
- It is having good tensile strength
- It is having low thermal conductivity
- It is having high thermal resistivity

Uses:

- Used for the purpose of heat insulation
- Used as heat insulating material in the form of floor mats
- Glass fibre products are stitched across the required size using asbestos or twisted glass fibre threads

5) Comparison and Difference between English Bond and Flemish Bond

For walls of thickness one and half bricks or more the strength is more for English Bond. For walls of one brick thickness Flemish Bond gives greater strength.

In English-bond, appearance on the facing is not pleasing.

In Flemish-bond, appearance on the facing is pleasing.

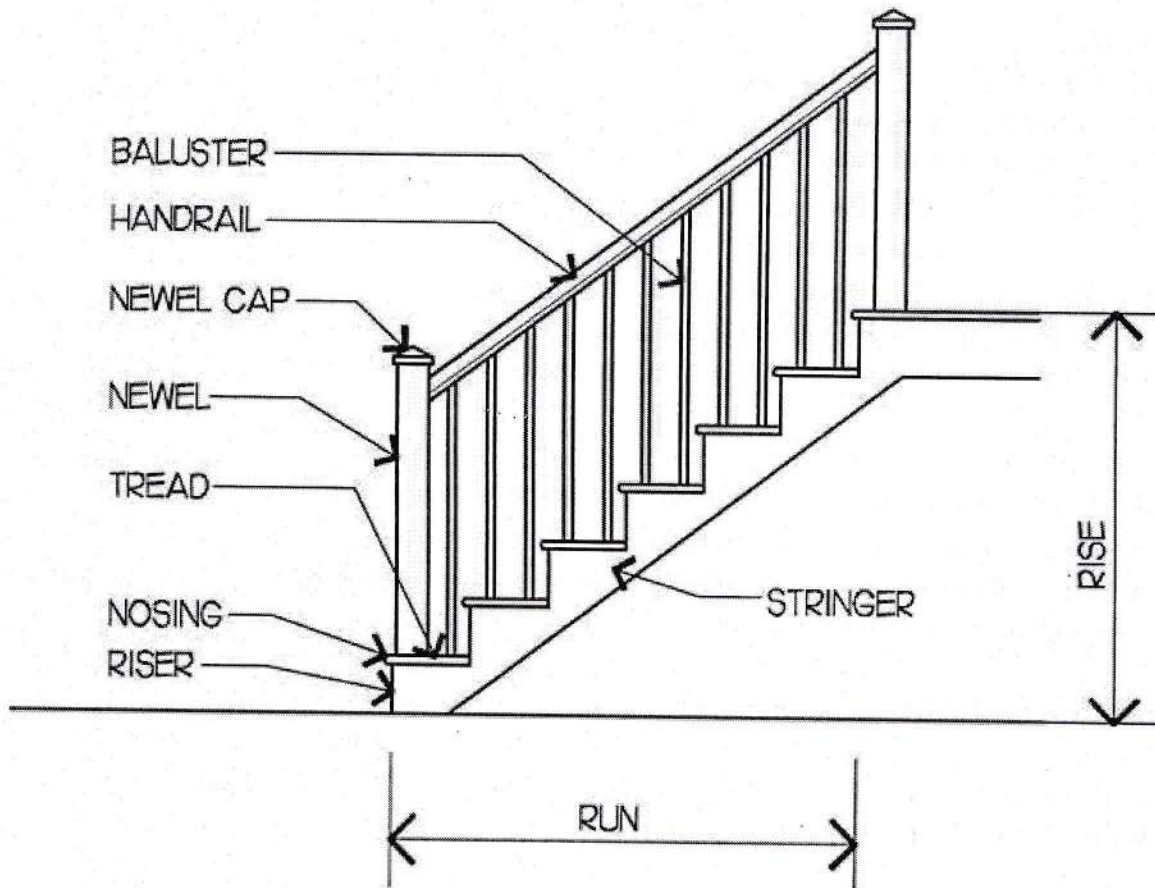
- In the first, it does not require skilled labour. In the second one, skilled labour is required.
- English Bond are More Costly. Flemish Bond are less costly due to using brick bats.
- English bond requires less mortar as compared to Flemish

6) Discuss the causes of dampness in building

- Poor quality of construction material

- Faulty construction or bad workmanship
- Due to dampness plasters become soft and crumbled
- It causes warping and decay of timber
- Electrical insulations are damaged
- The floor covering materials are deteriorated

7. With the help of a neat sketch mark the components of a stair



STAIRCASE TERMINOLOGY

PART-C

(III) (a) write the qualities of a good building stone

The following are the quality requirements of good building stones:

1. STRENGTH

Generally most of the building stones have high strength to resist the load coming on it. Therefore it is not of prime concern when it comes to check the quality of stones. But when the stones are to be used in large structures, it becomes necessary to check the compressive strength of stones.

Compressive strength of building stones generally fall within the range of 60 to 200N/mm².

2. DURABILITY

Building stones should be capable to resist the adverse effects of natural forces like wind, rain and heat. It must be durable and should not deteriorate due to the adverse effects of the above natural forces.

3. HARDNESS

When stones are used in floors, pavements or aprons of bridges, they become subjected to wearing and abrasive forces caused by movement of men or machine over them. So it is required to test hardness of stone.

Hardness of stone is determined by Mohs scale.

4. TOUGHNESS

Toughness of stones means its ability to resist impact forces. Building stones should be tough enough to sustain stresses developed due to vibrations. The vibrations may be due to the machinery mounted over them or due to the loads moving over them. The stone aggregates used in the road constructions should be tough.

5. SPECIFIC GRAVITY

The more the specific gravity of stone, the more heavier and stronger the stone is.

Therefore stones having higher specific gravity values should be used for the construction of dams, retaining walls, docks and harbors. The specific gravity of good building stone is between 2.4 and 2.8.

6. POROSITY AND ABSORPTION

Porosity of building stones depend upon the mineral constituent and structural formation of the parent rock. If stones used in building construction are porous then rain water can easily enter into the pore spaces and cause damage to the stones. Therefore building stone should not be porous.

7. DRESSING

Giving required shape to the stone is called dressing. It should be easy to dress so that the cost of dressing is reduced. However, the care should be taken so that, this is not be at the cost of the required strength and the durability.

8. APPEARANCE
In case of the stones to be used for face works, where appearance is a primary requirement, its colour and ability to receive polish is an important factor.

(b) Explain the specific gravity test of a cement.

Test Procedure:

1. The Flask should be free from the liquid that means it should be fully dry. Weigh the empty flask(W1)
2. Fill the cement on the bottle up to half of the flask (about 50gm) and weigh with its stopper (W2)
3. Add Kerosene to the cement up to the top of the bottle. Mix well to remove the air bubbles in it. Weigh the flask with cement and kerosene (W3)
4. Empty the flask. Fill the bottle with kerosene up to the top and weigh the flask (W4)

Calculation:

$$S_g = \left[\frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4) \times 0.79} \right]$$

Specific gravity of kerosene is **0.79 g/cc**

IV) (a) explain the methods of moulding of bricks

In the moulding process, prepared clay is mold into brick shape (generally rectangular). This process can be done in two ways according to scale of project.

- Hand molding (for small scale)
- Machine molding (for large scale)

Hand molding of bricks

If manufacturing of bricks is on a small scale and manpower is also cheap then we can go for hand molding. The molds are in rectangular shape made of wood or steel which are opened at the top and bottom. The longer sides of molds are projected out of the box to serve it as handles. If we take durability in consideration steel molds are better than wooden molds.

In hand molding again there are two types and they are

Ground molded bricks

Ground molded bricks

- In this process of ground molding, first level the ground and sand or ash is sprinkled over it.
- Now place the wet mold in the ground and filled it with tempered clay and press hard to fill all corners of the mold. Extra clay is removed with metal strike or wood strike or with wire.
- The mold is then lifted up and we have raw brick in the ground. And again wet the mold by dipping it in water and repeat the same process. The process of dipping mold every time to make bricks is called slop molding.
- Sometimes, the inside surface of mold is sprinkled with sand or ash instead of dipping in water this is called sand molding
- Frog marks of bricks are made by using a pair of pallet boards. Frog mark means the mark of depth which is placed on raw brick while molding. The depth may be 10mm to 20mm.
- Frog mark stats the trademark of manufacturing company and also it is useful to store mortar in it when the brick is placed over it.

Table molded bricks

- This process is similar to ground molding process, but here the bricks on molded on the table of size 2m x 1m.
- Ground molding is economical when compared to table molding.

Machine molding of bricks

The bricks required are in large quantity, then machine molding is economical and also saves more time. Here also we are having two types of machines,

1. Plastic clay machines
2. Dry clay machines

Plastic clay machines

These machines contain an opening in rectangular shape and when we place the tempered clay in to this machine it will come out through this opening. Now, the rectangular strips coming out the opening are cut by wires to get required thickness of brick. So, these are also called wire cut bricks. Now these raw bricks are ready for the drying process.

Dry clay machines

Dry clay machines are more time saving machines. We can put the blended clay into these machines directly without tempering. Means tempering is also done in this machine by adding some water. When the required stiffness is obtained the clay is placed in mold and pressed hard and well-shaped bricks are delivered. These are called pressed bricks and these do not require drying they may directly sent to burning process.

(b) Differentiate between Plain Cement Concrete and reinforced cement concrete

Plain Cement Concrete (PCC) is a construction material generally used as a binding materials and is composed of cement, (commonly Portland Cement) and other cementitious materials such as fly ash and slag cement, aggregate (generally a coarse aggregate made of

gravels or crushed rocks such as limestone or granite, plus a fine aggregate such as sand, water, and chemical admixtures.

Specifications for Plain Cement Concrete (PCC)

Materials Specifications

Aggregate shall be of inert materials and should be clean, dense, hard, sound, durable, non-absorbent and capable of developing good bond with mortar.

Coarse aggregate shall be of hard broken stone of granite or similar stone, free from dust, dirt and other foreign matters. The stone ballast shall be of 20mm size and smaller. All the coarse material should be retained in a 5mm square mesh and should be well graded such that the voids do not exceed 42%.

Fine aggregate shall be of coarse sand consisting of hard, sharp and angular grains and shall pass through a screen of 5mm square mesh. Sand shall be of standard specifications, clean and free from dust, dirt and organic matter. Sea sand shall not be used.

Cement shall be fresh Portland cement of standard ISI specifications and shall have the required tensile and compressive stresses and fineness.

Water shall be clean and free from alkaline and acid matters and suitable for drinking purposes.

Reinforced cement concrete

Concrete being weak in tension, reinforcement should be used to carry the tension. Such concrete is known as reinforced cement concrete.

V (a) write the characteristics of a good paint

Wearability:

Paint must be resistant to the wear and tear of the atmosphere and should maintain its color, smoothness and finish for a **long time**.

(1) Covering ability:

Paints should cover the body uniformly and homogeneously on which it is applied and the finish should be smooth and uniform.

(2) Ease of cleaning:

When it is required to clean the paint, it should be easy to remove i.e A good paint should not react chemically with the materials but should only cover its surface.

(3) Environmentally Friendly:

Paint should be water based and must not have any plasticizers or biocides as solvents.

(4) Aesthetic:

It should provide a comfortable room climate and must not allow moulds and algae to grow on it.

(b) Write short notes on Abrasives, adhesive and Asbestos

Abrasives are those materials used in operations such as grinding, polishing, lapping, honing, pressure blasting or other similar process. Abrasives come in different particle or grit sizes depending on how much material needs to be removed.

Materials used for abrasives are generally characterized by high hardness, and moderate to high fracture toughness.

Materials Used for Abrasives

Some materials that are used as abrasives include:

- Silicon carbide, generally used for non-ferrous metals
- Aluminum oxide or alumina, the most widely used abrasive, generally used for ferrous alloys, high tensile materials and wood.
- Diamond, most often used in ceramic grinding or final polishing due to high hardness and cost

1. adhesive material – a substance that unites or bonds surfaces together

The main varieties of adhesive are:-

Natural organic adhesive includes,

- Animal protein glue
- Blood albumen glue
- Casein adhesive
- Vegetable starch adhesive

Synthetic organic adhesive includes,

- Phenol formaldehyde
- urea formaldehyde
- products of cellulose
- vinyl glue

Asbestos refers to a set of six naturally occurring fibrous minerals.

Properties

- it is white ,grey or brown in colour and silky to touch
- it is fibrous in structure and flexible
- it is highly resistant to heat
- specific gravity of Asbestos board is about 2

VI (a) describe veneer,plywood,fibreboard and hard board

Veneer: it is the thin sheets of wood 0.4mm to 6mm in thickness obtained by different knife cutting process

Plywood: aboard formed by gluing together three or more layers of veneers

Advantages:

- decorative design can be formed by selecting figured veneers
- light in weight and has greater strength
- gives uniform tensile strength in all directions

fibre board: the board which are made by pressing the mixture of sawdust ,fibrous of wood and glue are known as fibre board

hard board: it is manufactured from raw materials like wood waste obtained from saw mills ,veneer manufacture ,furniture making etc.

(b) List the uses of PVC

- it is used for electric wiring and cable
- soft pvc is also used to make flexible sheet or film by squeezing it through rollers

- it is used to make motor car seat and furniture
- it is used to make the hand bag and suitcase covering
- it is used for making doors and windows
- it is used for making foot wear ,bottles ,gramophone record, water stops toys , tubes and floor covering

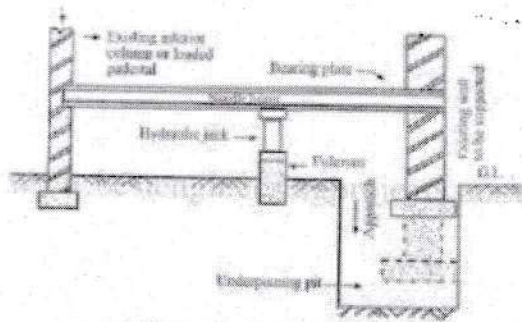
VII (a) write general principles to be observed during brick masonry construction

1. The brick must be soaked in water for 4 hour before use, to the full depth of brick. The advantage of soaking removal of dust particle, dirt and reduced tendency of absorb water from the mortar.
 2. The brick should be placed in horizontal plane
 3. The brick work should be uniformly in upward direction and the maximum distance should not be more than 1- 2 m in one day because newly constructed wall can be deform due to its self weight
 4. All the functions like space for door, window should be embedded on concrete
 5. All the joints should be filled up to a depth of 10- 15 mm with mortar
 6. Plastering should be done 28 days of completing of masonry to avoid any sort of deformation.
 7. When plastering is not done all the joints should be filled with mortar.
 8. All the masonry work should be cured for 7 days .
 9. A particular surface can be covered with jute and kept in moist condition.
 10. All partially Brick wall finished with a tooth end for the bonding of existing or new work.
- (b) explain the methods of underpinning**

PURPOSE OF UNDERPINNING:

1. To replace a defective foundation into a new foundation.
2. To increase the strength of an existing foundation.
3. To increase the load carrying capacity of a structure.

1. PIT METHOD:



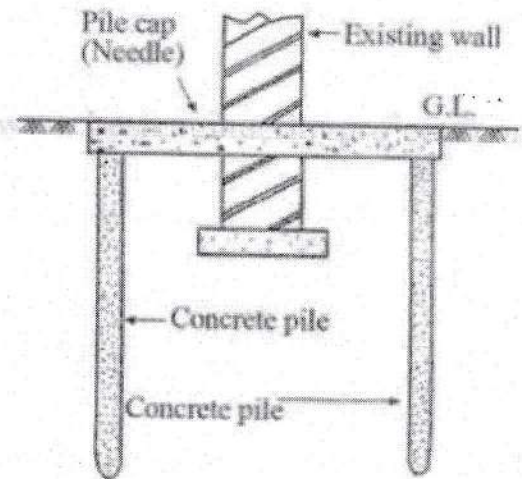
Pit Method

In this method, short length columns of 1.2 m to 1.8 m are underpinned. First, holes are cut in the wall above the ground level at common intervals and strong needles are then inserted through the holes to carry the entire load of the structure. Generally, the needles are made of timber beam or steel joist.

In case of RSI beams, wooden bearing plates are used between the beams and supporting wall to minimize the masonry crushing. Jacks are provided to support the needle beams. Jacks should be placed sufficiently away from the supporting walls to enable the working space for trench excavation and concreting.

When a foundation is required to be replaced, the section of the wall should be cut in 90 cm – 120 cm in length for new work to be built. Again, cut the next 90 cm to 120 cm length of the wall and rebuilt. Thus the wall foundation can be replaced.

2. PILE METHOD:

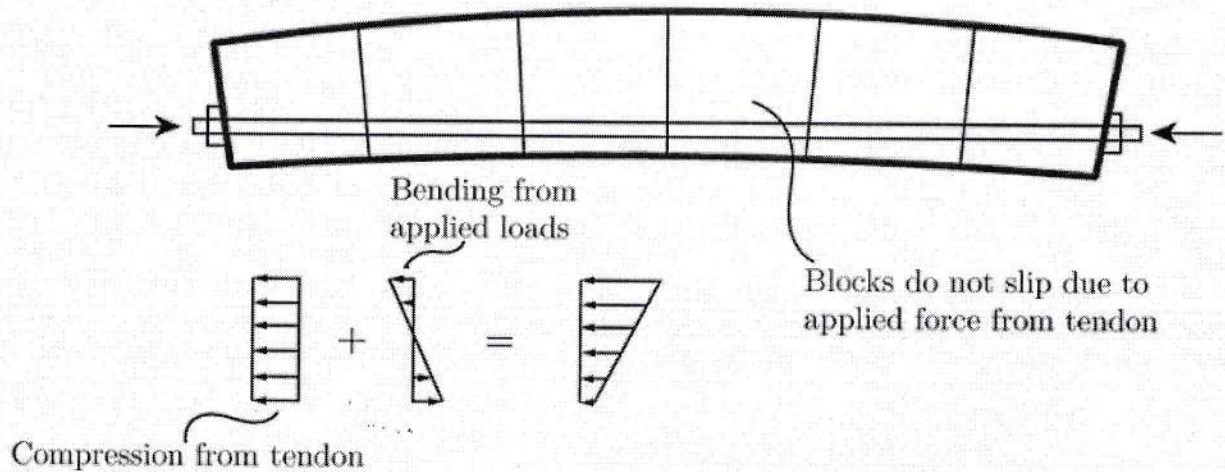


Pile Method

In this process, concrete piles are pushed on the both sides of the wall. The needle beams are then used over the piles through the wall, where the needle beams act as pile caps. It alleviates the load from the wall. This strategy is helpful for water logged soils where walls

convey heavy loads. In this situation piles and needle beams turn into a perpetual part of the establishment and existing foundation of the walls are not disturbed.

VIII(a) differentiate between pre tensioning and post tensioning



By controlling the amount of prestress, a structural system can be made either flexible [portal frame], or rigid [floor slab] without influencing its strength.

Prestressed, pre-tensioned, tendons are tensioned by a jack without any concrete. Then, concrete is poured, allowed to set and bond, at which time the ends are cut and the beam becomes instantly stressed by the tendons. Service loads can then be applied.

Prestressed, post-tensioned, tendons are tensioned by a jack after the concrete has already cured (but a duct is installed such that the concrete is unbounded to the prestressing), at which time the tendons are tensioned by means of a hydraulic jack, and the beam becomes stressed. Grout may or may not then infill the ducts. Grouting should typically be performed, to minimize the chance of a single tendon rupture causing catastrophic failure of the member. Service loads can then be applied.

Post-tensioning minimizes losses in prestress that are a result of concrete shrinkage. The only prestress loss due to shrinkage would come as a result of duct grout shrinkage. In addition, for pre-tensioned beams, because of concrete compressive strain at the instant that the tendons transfer the compressive force to the concrete beam (see figure below).

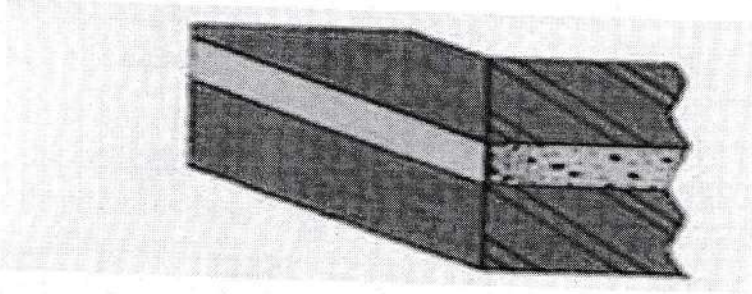
(b)Types of pointing:

- Flush pointing
- Recessed pointing
- Beaded Pointing
- Struck Pointing
- Rubbed, keyed or grooved pointing

- V- pointing
- Weathered pointing

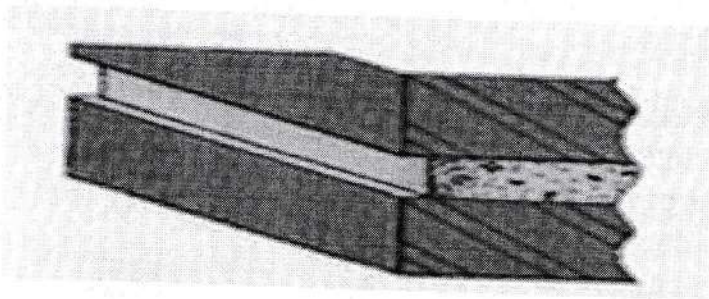
Flush pointing:

In This type of pointing mortar is pressed hard in the raked joints and by finishing off flush with the edge of masonry units. The edges are neatly trimmed with trowel and straight edge. It does not give good appearance. But, flush pointing is more durable because of resisting the provision of space for dust, water etc., due to this reason, flush pointing is extensively used.



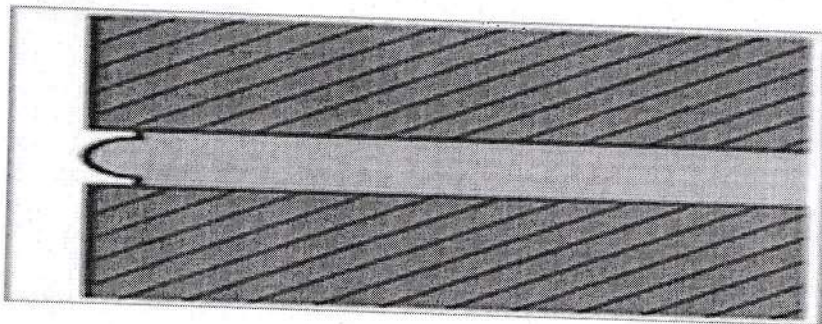
Recessed pointing:

In case of recessed pointing mortar is pressing back by 5mm or more from the edges. During placing of mortar the face of the pointing is kept vertical, by a suitable tool. This type of pointing gives very good appearance.



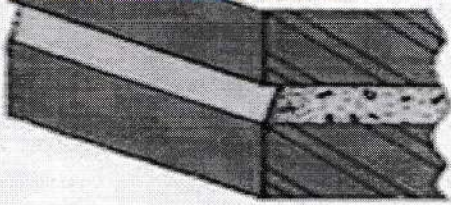
Beaded pointing:

It is a special type of pointing which is formed by a steel or ironed with a concave edge. It gives good appearance, but it will damage easily when compared to other types.



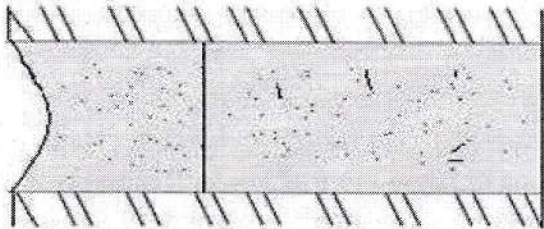
Struck pointing:

This is a modification of flush pointing in which the face the pointing is kept inclined, with its upper edge pressed inside the face by 10mm. struck pointing drains water easily.



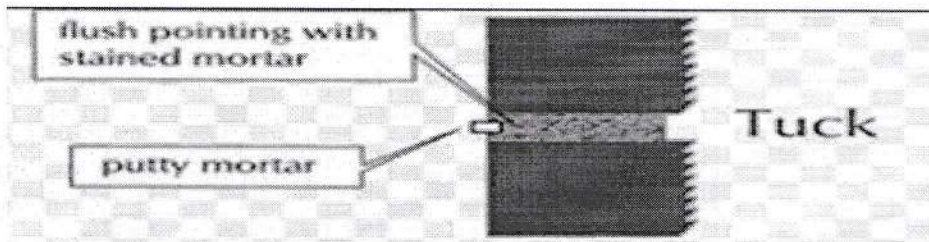
Rubbed, keyed or grooved pointing:

This pointing is also a modification of flush pointing in which groove is formed at its mid height, by a pointing tool. It gives good appearance.



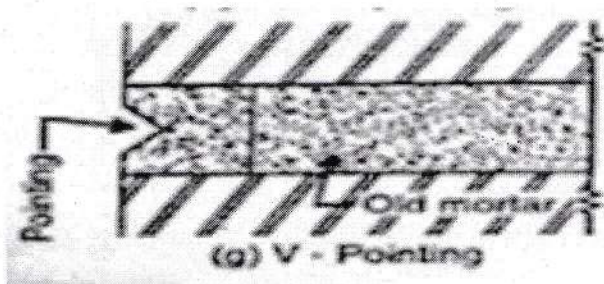
Tuck pointing:

In case of tuck pointing mortar is pressed in the raked joint first and finishing flush with the face. While the pressed mortar is green, groove or narrow channel is cut in the center of groove which is having 5mm width and 3mm depth. This groove is then filled with white cement putty, kept projecting beyond the face of the joint by 3 mm. if projection is done in mortar, it is called bastard pointing or half tuck pointing.



V- Pointing:

This pointing is formed by forming V-groove in the flush-finishing face.



Weathered pointing:

This pointing is made by making a projection in the form of V-shape.

There are two basic components of a building.

1. Sub Structure: The part of building that is constructed below ground level.
2. Super Structure: The part of building that is above ground level.

SUB-STRUCTURE

footing and plinth of a building are a part of a sub-structure. This part of building safely transfers the load of building to the underlying soil. Therefore, footing should be of such strength that it can easily carry the building load. Failure of footing leads to failure of building. Width and depth of footing should be designed according to the load of a building coming on it plus the bearing capacity of soil.

Bottom part of footing is generally constructed of Plain Cement Concrete (P.C.C) or Reinforced Cement Concrete (R.C.C). Steps are made above (P.C.C) by using bricks, stones or concrete to reach the plinth level. Generally, Damp Proof Course (D.P.C) is laid on plinth level. This layer stops the penetration of moisture to the super structure part of a building.

SUPER STRUCTURE

Super-structure is a part of structure that is above plinth level (P.L). Generally columns and walls are constructed in super structure. Following are the important parts of super-structure.

1. Floor
2. Roof
3. Lintel
4. Parapet
5. Sun Shade
6. Drip Course
7. Doors & Windows

FLOOR

Floor is that part of a building on which furniture, household, commercial, industrial or any other type of items are stored. Floor is used for walking around .

Floor separates the different levels of a building. Building is also named with reference to floor. Like Ground floor, first floor, or a floor that is below ground level like basement floor.

ROOF

Roof is made to cover room from upper face. Different types of roofs are used in building depending on the location and weather. Sloping roofs are generally considered better in mountain areas. While, in plan areas flat roofs are preferred.

LINTEL

Lintel is constructed above doors, windows etc. to support load of wall on openings. Lintel beam is generally made as reinforced cement concrete member. While, in residential houses sometime lintel is made by using concrete and bricks.

Breadth of lintel is generally equals to the breadth of wall. In case of metric unit, it is normally equals to 10cm, 15cm, 20cm etc. While, in case of FPS system it is consider as 6", 9", 12" etc.

Thickness of lintel should not be less than 10cm (4.5") and maximum thickness of lintel should not be more than its breadth.

PARAPET

External walls of a building are extended above the roof slab which is known as parapet. The sole purpose of parapet is to retain water from its entrance in to the walls and a safety protection for people who use the roof of a building.

There are following three types of parapets;

1. American Type
2. Setback Type
3. Cornice Type

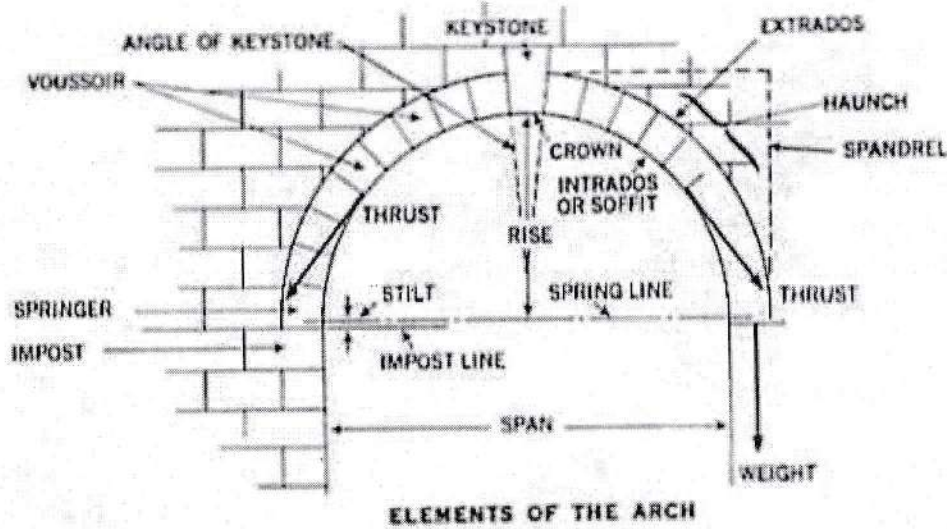
SUN SHADE

Sun shade is a slab that is cast on the top of doors and windows. Sun shade protects doors and windows from sun and rain. Sun shade is cast monolithically with the lintel.

(b) write the requirements of a good floor

- Strength and stability
- Resistance to weather and ground moisture
- Durability and free from maintenance
- Fire resistance
- Resistance to passage of heat
- Resistance to passage of sound

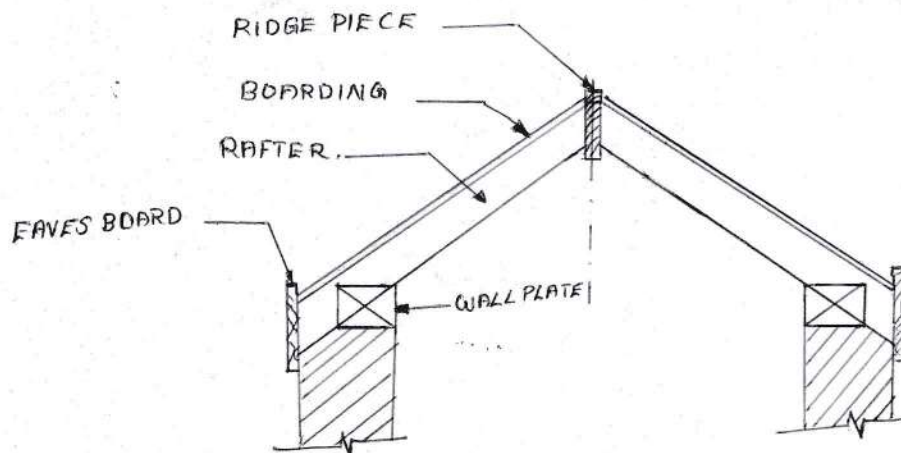
X (a) draw a semi-circular arch and mark their parts



(b) Discuss different types of trusses for pitched roof

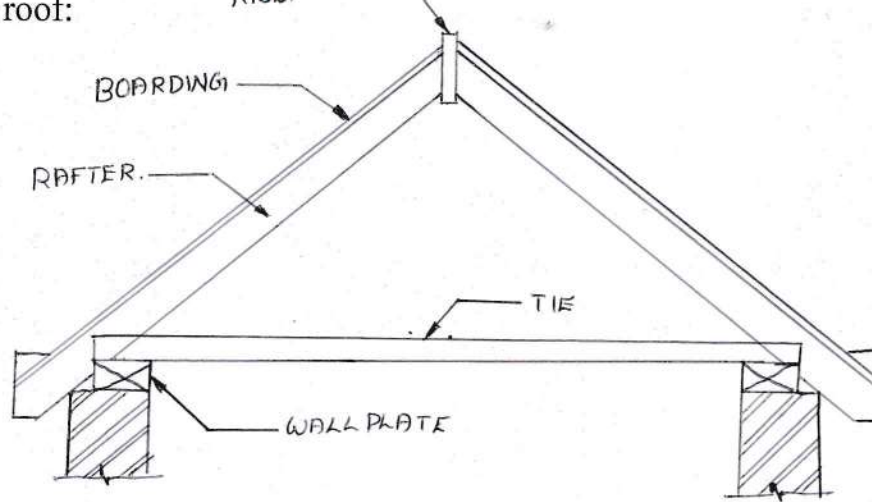
- Couple roof
- Couple close roof
- Collar beam roof
- Collar and tie roof
- King post truss
- Queen post truss
- Steel truss

Coupled roof:



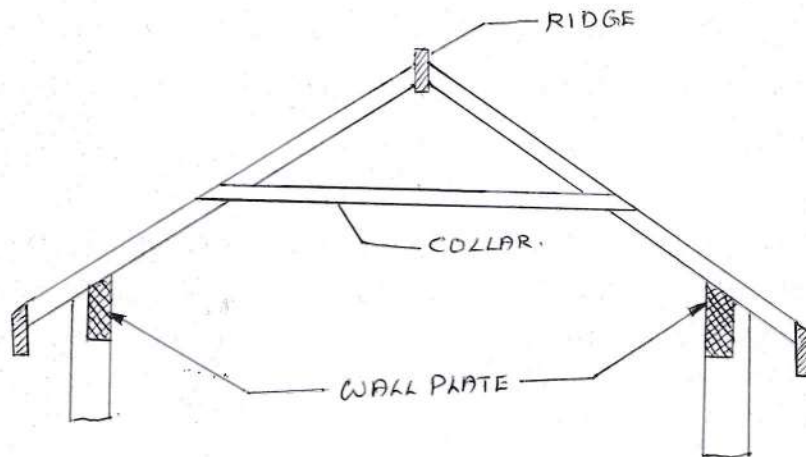
Coupled roof is formed by a pair of inclined rafters. Their upper ends are nailed to a common Ridge piece and their lower ends are notched and nailed to the wooden wall plates. These wall plates in turn are fixed over the rafters suitable spaced. Over the battens the suitable roof covering material is fixed.

Couple close roof:



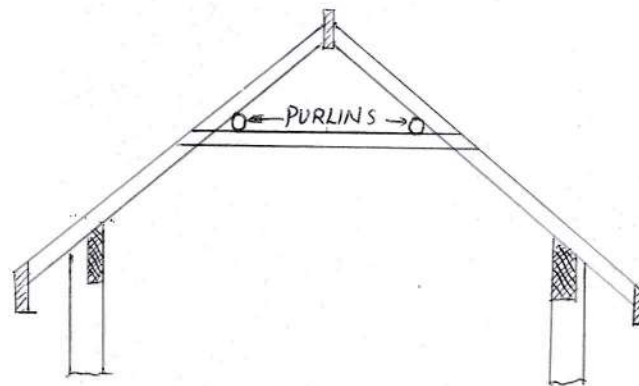
This roof is similar coupled roof except the feet of the rafters are joined by a tie, which by holding them in positions prevents them from spreading and thrusting out of the wall. With ordinary loading conditions this type of roof can be used for spans upto 5 metres.

Collar beam roof:



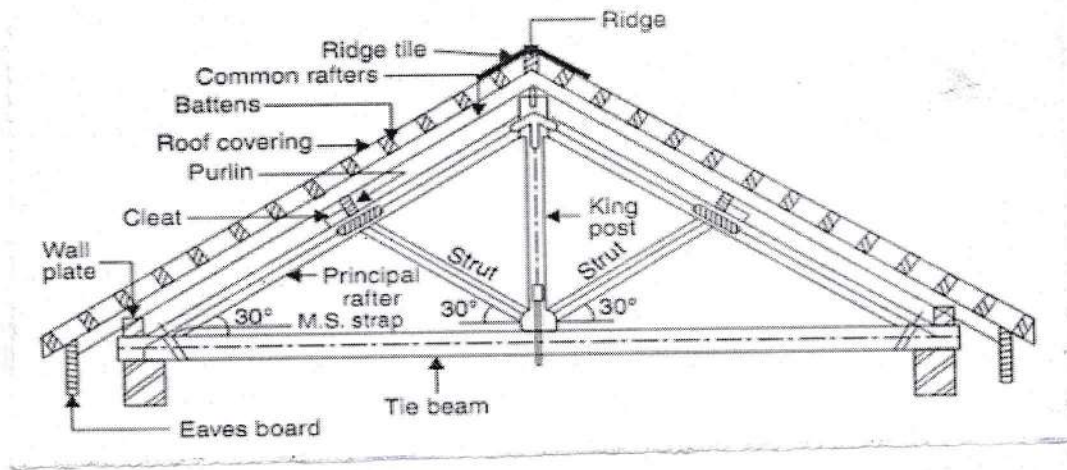
This type of roof can be used for spans between 4 metres and 5.5 metres., a collar of the same width as the rafter is fixed to every pair of rafters and it is attached at a height of half tone third of the vertical height between the wall and the ridge.

Collar and tie roof:



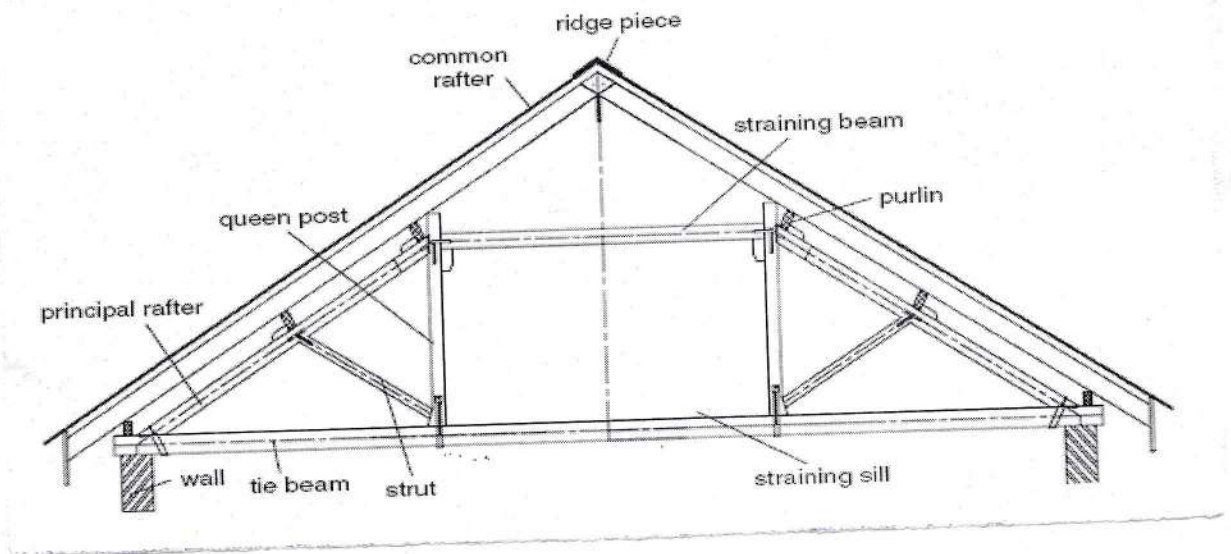
This type of roof can be used when the roof span exceeds 5.5 metres. It is a combination of collar beam roof and couple close roof. The rafters are supported by purlins rest at the ends on walls.

King post truss:



This particular truss is made out of wood most of the time. But it can also be built out of a combination of steel and wood. It all comes down to the architect and the building structure. The king post truss spans up to 8 m. which makes it perfect for multiple types of houses. Especially the smaller ones.

Queen Post Truss



The Queen Post Truss is designed to be a very reliable, simple and versatile type of roof truss that you can use at any given time. It offers a good span, around 9-14m, and it has a simple design which makes it perfect for a wide range of establishments.

Steel trusses:

The steel trusses are commonly used for spans greater than 12 metres. For the fabrication of steel trusses various standard shapes and sizes of rolled steel sections are available

