SECTION-I

(Stones, sand)

1. Write the geological classification of rocks with examples. 10

This classification is based on mode of formation of rock. According to it Rocks are of following three types.

i) Igneous Rocks
ii) Sedimentary rocks
iii) Metamorphic rocks.

i) Igneous rocks:

These rocks are formed due to cooling of Magma above or below the earth surface. Depending upon the rate of cooling of magma these rocks are further classified in to following three types.

a) **Plutonic rocks:** These rocks are formed due to cooling of magma at great depth from earth surface. The cooling is very slow hence these rocks possess coarse grained structure. Example; Granite.
b) **Hypabyssal rocks:** These rocks are formed due to cooling of Magma at shallow depth from the earth surface. The cooling is fast hence these rocks possess fine grained structure. Example: Dolerite.
c) **Volcanic rocks:** These rocks are formed due to cooling of magma on the earth surface. The cooling is very fast, hence these rock possess extremely fine grained structure. Example : Basalt

ii) Sedimentary Rocks; These rocks are formed due to deposition of product of weathering on pre-existing rocks. The product of weathering are carried away by weathering agencies such as wind, rain, frost flowing water etc. Following four types of deposits occur:

a) Residual deposit: The product of weathering remains at the site of origin consolidate and form rock such deposit called residual deposit.
b) Sedimentary deposit: The insoluble products of weathering are carried away in suspension from the place of origin to some other place and deposited there such deposit is called as sedimentary deposit,
c) Chemical deposit: The product of weathering is carried in solution they will get deposited by some physio-chemical process such as Evaporation and precipitation
d) Organic deposit: These are the deposit of plant and animal remains.

Metamorphic Rock: Pre-existing rocks such as igneous or sedimentary rocks when subjected to high temperature or pressure they undergo change in their character, The process of change in the character is known as Metamorphism and the stone obtained after metamorphism are called Metamorphic rocks. Ex; Marble, Laterite, Murom, Gneiss, Slate etc. Following four types of Metamorphism takes place in nature

a) Thermal Metamorphism: Metamorphism occurs due to effect of temperature only.
b) Cat clastic Metamorphism: Metamorphism occurs due to effect of Pressure only
c) Dynamo thermal Metamorphism: Metamorphism occur due to combined effect of Temperate and pressure.
d) Plutonic Metamorphism: Metamorphism occur in depth.

2. Write the characteristics/Requirement of a good building stone. 10

Following are the characteristics of a good building stone

1. Compressive strength.
2. Appearance
3. Durability
4. Facility of dressing
5. Fracture
6. Hardness
7. Percentage of wear
8. Resistance to Fire
9. Seasoning
10. Specific Gravity
11. Texture
12. Toughness index
13. Water absorption

1.Compressive strength: The compressive strength of a good building stone should be greater than 100N/mm2. The compressive strength of some of stones are as follows.

Granite:100 to 125 N/mm2
Basalt: 150 to 200N/mm2
Marble: 65N/mm2
Sand stone: 60N/mm2
Laterite:5 N/mm2

2.Appearance: The stone which are used for face work should have decent in appearance, Stone should preserve its colour for long time. Light coloured stones are preferred than dark coloured stones because lite coloured stones are stronger and more durable than dark coloured stones.

3. Durability: The good building stone should be durable that it should have good resistance to weathering agencies, such as Rain, Frost, Breeze, Wind Sunshine, Alternate conditions of wetness and drying, Heating and cooling etc. Stone which contain CaCO3 (Calcium carbonate) are generally not durable stones.

4. Facility of dressing: good building stone should be easy to cut

5.Fracture: Freshly cut surface of stone is called as fracture. The fracture of stone should be Sharp, Clear, Homogeneous and free from patches and earthy materials.

6.Hardness: Resistance to wear and tear is called Hardness. Hardness is measured in terms coefficient of hardness.

Coefficient of Hardness	**Type of stone**
More than17	Hard
14 -17	Moderately in Hard
Less than 14	Poor in Hardness

7. Percentage of wear: For good building stone the percentage of wear should not be more than 3%

8. Resistance to Fire: The stone should preserve its shape when exposed to high temperature. For good fire resistance the coefficient of thermal expansion of all the minerals should be same.

9 Seasoning: Freshly quarried sone from bed of rock contain moisture called quarry sap. The presence of quarry sap makes stone soft, hence stone should be dried before put in to use. A period of 6-12 month is considered as sufficient for complete drying of stones.

10. Specific gravity: The specific gravity of good building stone should be greater than 2.7. Because Heavy stones are stronger and more Durable than light weight stones.

11. Texture: A good building stone should have compact granular structure which should be free from Voids, cavities, and patches of loose materials.

12. Toughness; Ability to withstand shock load impact load is called as Toughness. The toughness is measured in terms of Toughness index.

Toughness index	**Type of stone**
More than19	Tough
13-19	Moderately in Tough
Less than 13	Not Tough

13.Water absorption: For good building stone the percentage of water absorption should not be more than 0.6%

3. List the various causes of deterioration of stones. 10

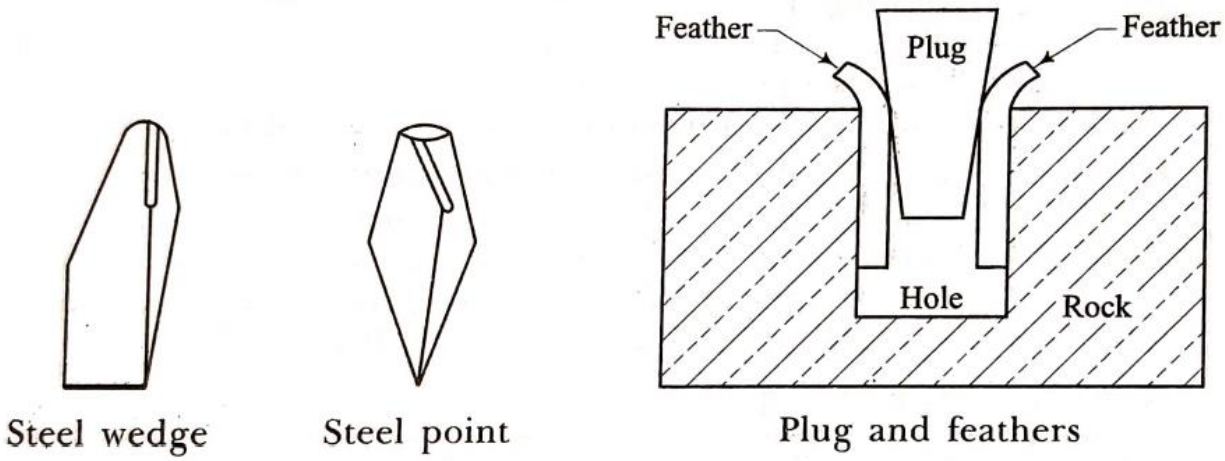
The stone deteriorates due to physical chemical actions of the atmosphere. Following are the causes of decay of stone.

1. Alternate wetness and drying.
2. Frost
3. Impurities in atmosphere.
4. Living organisms.
5. Movement of chemicals.
6. Nature of Mortar.
7. Rain water.
8. Temperature variation.
9. Vegetable growth.
10. Wind.

1. Alternate wetness and drying: The stone are made wet by Rain, Frost Dew, etc. Such wet surface is dried by sunshine. Stone subjected to such alternate wetness and drying wear out quickly.
2. Frost: In hilly stations or very cold places, the moisture present in the atmosphere is deposited in the pores of stones. At freezing point, this moisture freezes and in doing so, it expands in volume and causes splitting of stone.
3. Impurities in atmosphere: The atmosphere contain various impurities which have adverse impacts on stones. For example, Acids and Fumes are predominant in industrial town. These impurities act on carbonate of lime and cause deterioration of stone.
4. Living Organisms: Some living organisms like Worms Bacteria act upon the stones and deteriorate them by making holes in stones, and they also secrete some organic chemicals which have corrosive actions
5. Movement of chemical: For example, If Sand stone is placed below the lime stone, The chemical brought down from lime stone by rain water or any other reason, will cause decay of sand stone.

6. Nature of Mortar: The nature of mortar used as binding material in stone masonry, may be such that it may react chemically with stone and may lead to disintegration of stone.
7. Rain water: The rain water as it descends through atmosphere to the earth surface, absorb carbon dioxide, (Co_2), Hydrogen Sulphide (H_2S) and other gases present in atmosphere. These gases act adversely on stones and causes decay of stones.
8. Temperature variation: The rise in temperature results in expansion of stones, the fall in temperature causes contraction of stones. The stones easily deteriorate due to setting up of internal stress.
9. Vegetable growth: The creepers and certain trees developed on stone surface keep stone surface damp, at the same time roots of creeper try to expand. Such action accelerates the decay of stone.
10. Wind: Fast blowing wind contain fine particles, will strike against the stone surface and causes decay stones.

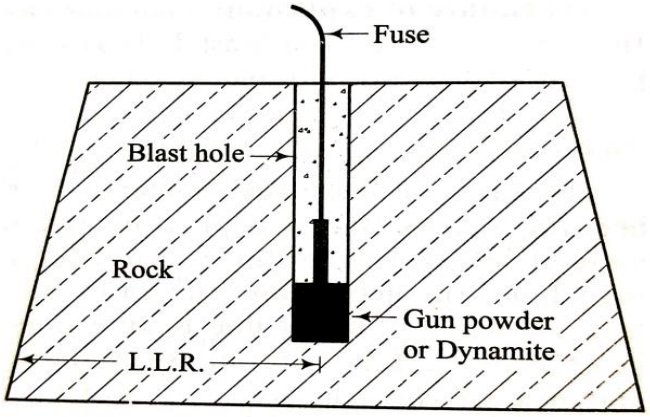
4. What is quarrying? Explain the quarrying by wedging with a neat sketch. 10



- This method is adopted if the Rock contain natural cracks or fissures, through which steel wedges and points are driven by using Hammer to extract stones from bed of Rock.
- If natural cracks are absent artificial cracks are to be formed by drilling series of holes on the rock surface. The diameter of the hole is 20mm, depth of the hole is 200mm and distance between the hole is 150mm.
- Each hole is provided with a plug and pair of feathers. Plug is conical shaped steel wedge, where as feather is a flat steel plate with curve at its top.
- The plug is placed in between the feathers, and all the plugs are simultaneously driven by Hammer. A great lateral Force is developed by which crack is formed along the line of holes.
- The detached portion of stone is removed by using crow bar or shovel.
- If rock is comparatively soft then wooden plugs are driven. The wooden plugs are kept soaked in water, when plug swell a great force is developed and rock split along the line of holes.
- This method is adopted to extract stones from costly rocks such as Sand stone, Marble, Lime stone etc. Whenever is possible Wedging is preferred than Blasting.

5. Define quarrying? Explain the process of quarrying by Blasting. 10

The process of extraction of stones from bed of rock is known as quarrying.



Process of blasting

1. Blast holes of required diameter and depth are drilled by using Dippers and jumpers.
2. While drilling the holes some quantity of water is also added which makes the stone soft and stone powder is converted in to paste such paste can be easily removed by using scrapping spoon.
3. Blast holes are cleaned by rotating the rod tied with cloth/Rag at its end
4. Required quantity of blasting powder or Gun powder is placed at the bottom of the Blast hole.

The quantity of blasting powder to be placed inside the blast hole is calculated using following formula.

Blasting Powder in "N" = (Line of least Resistance in "m")^{2}X 1.5

5. The Priming Needle which is coated with grease is placed at the centre of blast hole. The remaining portion of the blast hole is filled with stone powder in layers.
6. Each layer of stone powder is thoroughly compacted by using Tamping bar. While tamping is being done the tamping bar is slowly rotated so that it can removed easily after tamping is competed.
7. When tamping operation is finished, the priming needle is taken out slowly, leaving a long narrow hole and it is filled with blasting powder.
8. One end of the fuse is inserted inside the blast hole and other end of sufficient length is kept projecting outside the hole.
9. He free end of the fuse is fired; this can be done with match box or with electricity.
10. Explosion takes place and rock is disintegrated in to small blocks.

5. Mention the 5 qualities of Ideal preservative. 5

1. It should not allow moisture to penetrate in the stone surface.
2. It should not develop objectionable colour.
3. It should resist effect various atmospheric agencies.
4. It should easily penetrate in to the stone surface.
5. It is economical.
6. It is non corrosive and harmless.
7. It remains effective for long time.
8. It is easy to apply.
9.

7. Write a note on preservation of stone 7

The decay of Building stone of inferior quality is some extent prevented by applying some preservative chemicals is known as Preservation of stones.

1. **Coal Tar**: If coal tar is applied on stone surface, it preserves stone. This preservative is not generally adopted because it spoils the beauty of stone.
2. **Linseed oil**: This preservative may be used either raw Linseed oil or boiled linseed oil. The raw linseed oil does not disturb original shade of the stone. But require frequent renewal, usually once in year. The boiled linseed oil last for long, but it makes stone surface dark.
3. **Paint**: Application of paint on stone surface also serve as good preservative. The paint changes the original colour of the stone.
4. **Paraffin**: This preservative may be used alone or it may be dissolved in neptha and then applied on the stone surface. It also changes the original colour of the stone.
5. **Solution of Alum and Soap**: The Alum and Soap are taken in proportion of 0.75N and 0.5N respectively, and they are dissolved in one litre of water. This solution when applied on stone surface act as preservative.
6. **Solution of Baryta**: A solution of baryta Ba $(OH)_2$ when applied on stone surface, act as a preservative. This preservative is used when decay of stone is mainly due to calcium sulphate ($CaSO_4$). Following chemical reaction is takes place.

$$Ba(OH)_2 + (CaSO_4) = BaSO_4 + Ca(OH)_2$$

8. Write Five qualities and Five uses of sand. 10

Properties of good sand:

- It should be chemically inert.
- It should be strong and durable.
- It should be clean and free from coatings of clay and silt.
- It should be free from any organic or vegetable matter.
- It should contain sharp, angular, coarse and durable grains.
- It should not contain salts which attract moisture from the atmosphere.
- It should be well graded i.e., should contain particles of various sizes in suitable proportions. Its size varies between 4.75mm and 0.15mm.
- The fineness modulus of sand should be between 2 and 3.

Uses of sand:

- Sand is used in cement mortar, lime mortar for stone masonry, bricks masonry.
- Sand is used in plane cement concrete, reinforced cement concrete, precast concrete, prestressed concrete.
- Coarse sand is used for face plaster on external walls.
- Fine sand is used for plastering to give a smooth surface to the wall.
- The sand serves as a drainage material and is therefore used in filtration plants, filling behind retaining wall, around the foundation,
- Sand is used below flooring material to provide a hard and level surface.
- Sand is used for filling underground floors, behind retaining walls and foundation fillings.
- Sand is also used for soil compaction in the form of sand piles.
- Most sand has a lot of quartz; it is used to manufacture glass.

SECTION-II (Bricks)

1. Explain the constituent of good brick earth. Mention the harmful ingredients of brick. 10

Good brick earth should compose of following ingredients.

1. Alumina
2. Silica
3. Lime
4. Iron oxide
5. Magnesia.

Alumina:

- A good brick earth should contain about 20 to 30% of Alumina
- Alumina gives plasticity property so that it can be moulded in to desired shape and size.
- If Alumina present in excess the bricks shrink, crack and warp during burning.

Silica:

- A good brick earth should contain about 50 to60% of silica. Silica is added in the form of sand.
- It prevents shrinkage of brick during drying and burning. Hence it gives uniform shape to the brick.
- If silica present in excess the brick become brittle and break easily.

Lime:

- A small quantity of lime not more 5% is added to good brick earth.
- Lime should be added in the form of fine powder.
- It prevents shrinkage of brick during drying and burning.
- It fuses the sand at kiln temperature, Fused sand act as cementing material, brick get strength through it.

Iron oxide:

- A good brick earth should contain about 5 to 6% of Iron Oxide
- It helps lime to fuse the sand, and It gives red colour to the Bricks.
- Excess of Iron oxide make brick dark blue or blackish.

Magnesia:

- A small quantity of Magnesia is added to brick earth which gives yellow colour to the bricks.
- It also prevents Shrinkage of bricks during drying and burning

2. Explain preparation of clay for manufacture of bricks. 10

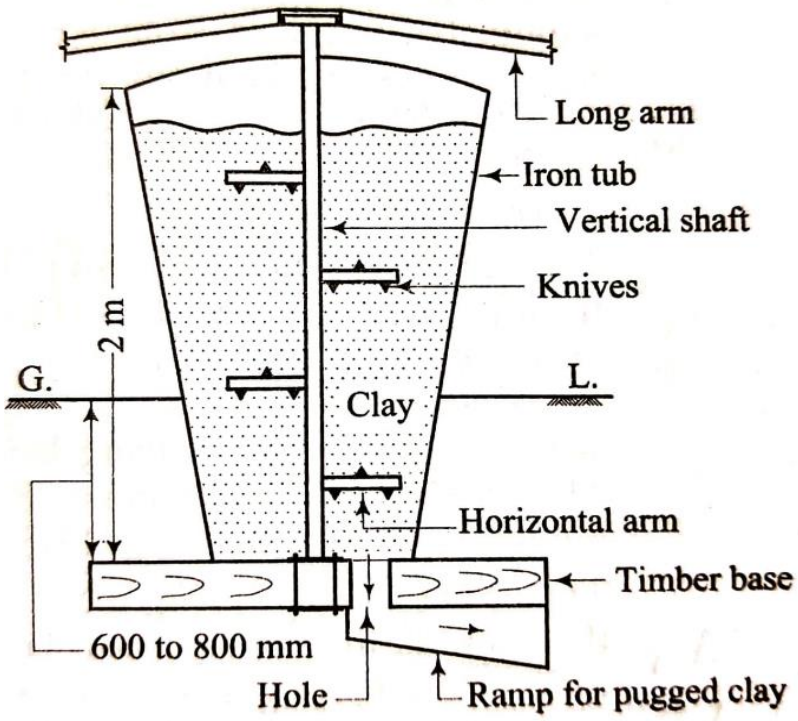
Clay for the brick is prepared in following order.

a) **Unsolining**: The top layer of soil about 20cm in depth is taken out and thrown away because it contains full of impurities hence it is not used in preparation of bricks.
b) **Digging**: The Clay is excavated from the pit and spread in the form of heap. The height of heap is about 1 to 1.2m.
c) **Cleaning**: The clay is cleaned off from stones, pebbles and vegetable matters. The lump of of clay should be converted in to powder form.

d) **Weathering**: The clay is exposed to atmospheric agencies for softening. The period of exposure may vary from 2 to 3 weeks to full season. Generally, the clay is excavated just before monsoon and allow it to weather throughout the Monsoon.
e) **Blending**: The clay is mixed with other ingredients in a suitable proportion.
f) **Tempering**: In this process clay is mixed with sufficient quantity of water and the mixture is pressed under the feet of men or cattels. For manufacture of bricks on large scale, the tapering is usually done in Pugmill.

3. Explain the process of tempering of clay using Pug mill. 10

Pugmill: For manufacture of bricks on large scale, the tapering is usually done in Pugmill.



Pug mill

Construction details: The Pugmill is consist of conical shaped iron tub, fixed on the timber base. The diameter of iron tub is 80cm at bottom and 1m at top. A hole is provided at the bottom of the tub to take out the pugged clay. A provision is made at the top to insert clay and water. The total height of the pugmill is about 2m, out of which 60 to 80cm is below the ground level. A vertical shaft with horizontal arm is provided at the centre of tub. one end of the vertical shaft is fixed to the timber base with swivel joint and other end is fixed to the two long arms. The vertical shaft is rotated by rotating the two long arms the long arms can be rotated by using pair of Bullocks.

Working: In the beginning, the hole which is provide at the bottom of the pugmill is closed and clay and water is placed in the pugmill from top. When vertical shaft is rotated by a pair of bullocks the clay is thoroughly mixed with water by the action of horizontal arms and knives. When clay has been sufficiently pugged the hole provided at the bottom of tub is opened and the pugged clay is taken out.

4. Write the characteristics of good bricks. 10

The good bricks which are to be used for the construction of important structures should possess the following qualities:

(i) The bricks should be table-moulded, well-burnt in kilns, copper-coloured, free from cracks and with sharp and square edges.

(ii) The colour should be uniform and bright.

(iii) The bricks should be uniform in shape and should be of standard size.

(iv)The bricks should give a clear metallic ringing sound when struck with each other.

(V)The bricks when broken or fractured should show a bright homogeneous and uniform compact structure free from voids.

(v) The brick should not absorb water more than 20 per cent by weight for first class bricks and 22 per cent by weight for second class bricks, when soaked in cold water for a period of 24 hours.

(vi) The bricks should be sufficiently hard. No impression should be left on brick surface, when it is scratched with finger nail.

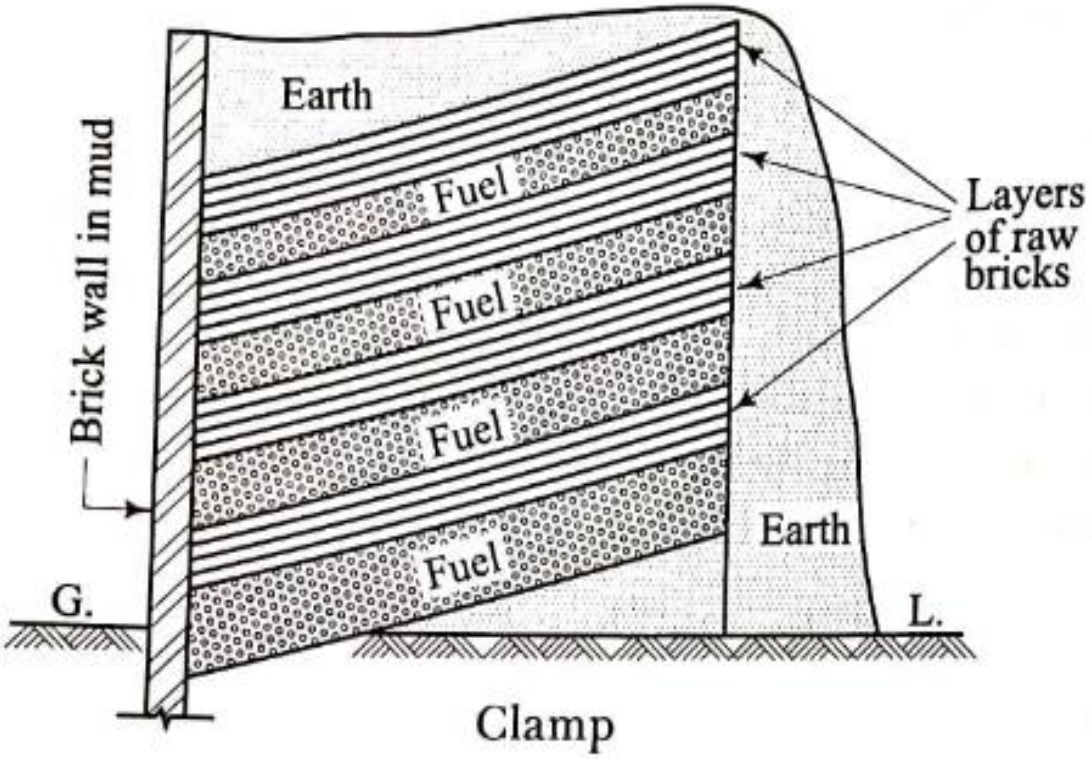
(vii) The bricks should not break into pieces when dropped flat on hard ground from a height of about one metre.

(viii) The bricks should have low thermal conductivity and they should be sound-proof.

(ix) The bricks, when soaked in water for 24 hours, should not show deposits of white salts when allowed to dry in shade.

(x)No brick should have the crushing strength below 5.50 N/mm^2.

5. Explain with sketch burning of brick by Clamp . 10



Following procedure is adopted in construction of clamp:

(i) A piece of ground is selected. Its shape in plan is generally trapezoidal. The floor of clamp is prepared in such a way that short end is slightly in the excavation and wider end is raised at an angle of about 15° from ground level.

(ii) The brick wall in mud is constructed on the short end and a layer of fuel is laid on the prepared floor. The fuel may consist of grass, cow dung, litter, husks of rice or ground nuts, etc. The thickness of this layer is about 700 mm to 800 mm. The wood or coal dust may also be used as fuel.

(iv) A layer, consisting of 4 or 5 courses of raw bricks, is then put up. The brick are laid on edges with small spaces between them for the circulation of air A second layer of fuel is then placed and over it, another layer of raw brick is put up. Thus alternate layers of fuel and raw bricks are formed. The thickness of fuel layer gradually decreases as the height of clamp increases The total height of a clamp is about 3 m to 4 m. When nearly one-third height is reached, the lower portion of the clamp is ignited. The object for such an action is to burn the bricks in lower part when the construction of upper part of clamp is in progress.

(vi) When clamp is completely constructed, it is plastered with mud on sides and top and filled with earth to prevent the escape of heat. If there is any sudden and violent outburst of fire, it is put down by throwing earth or ashes. The clamp is allowed to burn for a period of about one to two months. (viii) It is then allowed to cool for more or less the same period as burning.

(ix) The burnt bricks are then taken out from the clamp.

6. What are the advantages of clamp burning. 5

Advantages of clamp burning:

Following are the advantages of clamp burning:

(1) The burning and cooling of bricks are gradual in clamps. Hence the bricks produced are tough and strong.

(2) The burning of bricks by clamps proves to be cheap and economical. No skilled labour and supervision are required for the construction and working of clamps.

(3) The clamp is not liable to injury from high wind or rain.

(4) There is considerable saving of fuel.

7. Explain with sketch burning of brick by Hoffman's Kiln. 10

This kiln is constructed overground and hence it is sometimes known as the flame kiln. Its shape is circular in plan and it is divided into a number of compartments or chambers. As a permanent roof is provided, the kiln can even function during rainy season.

Hoffman's kiln with 12 chambers, Each chamber is provided with the following:

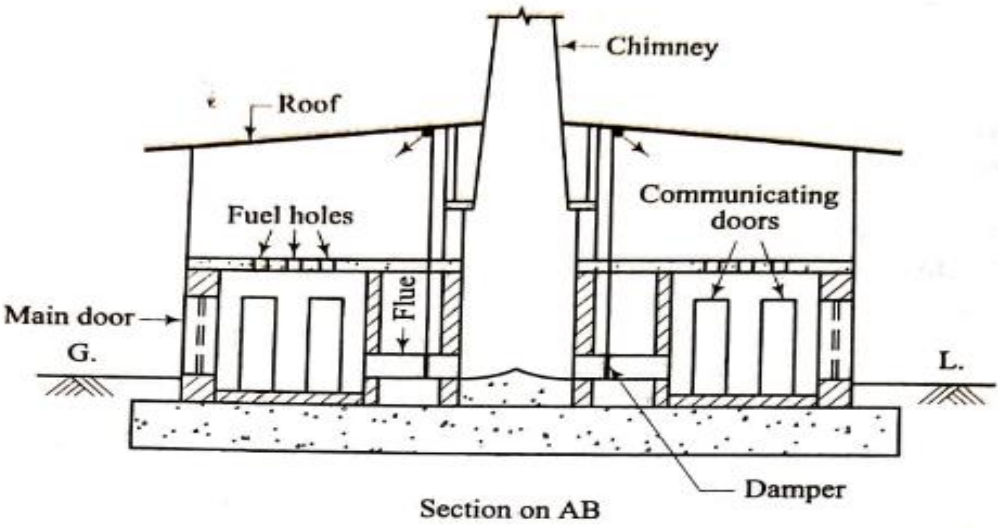
(a) a main door for loading and unloading of bricks,

(b) communicating doors which would act as flues in open condition,

(c) a radial flue connected with a central chimney, and

(d) fuel holes with covers to drop fuel, which may be in the form of powdered coal, into burning chambers. The main doors are closed by dry bricks and covered with mud, when required. For

communicating doors and radial flues, the dampers are provided to shut or open them. In the normal condition, only one radial flue is connected to the chimney to establish a draught.



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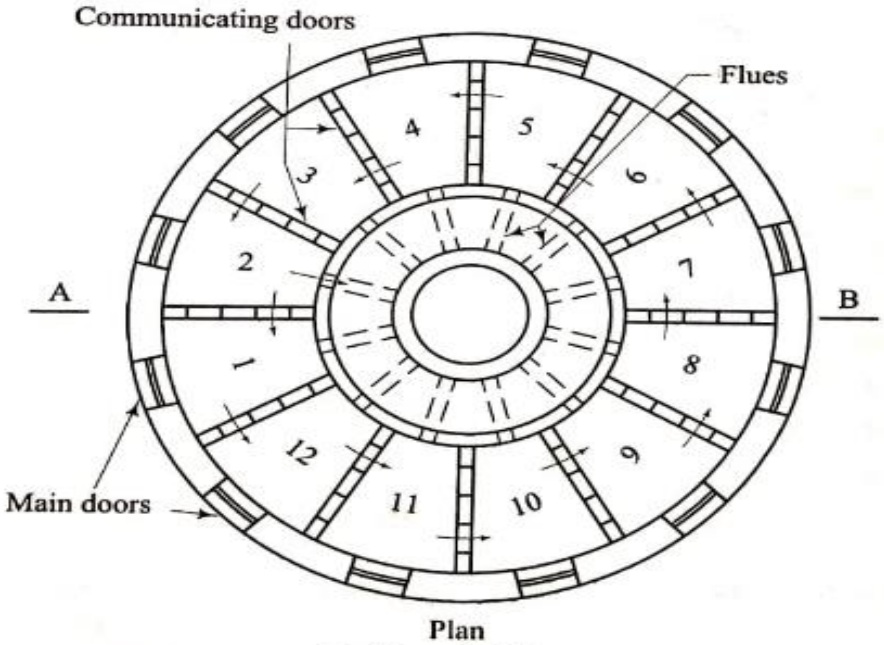


Plan

Hoffman's kiln

In this type of kiln, each chamber performs various functions in succession, namely, loading, drying, burning, cooling and unloading.

Chamber 1 ----------Loading

Chambers 2 to 5-------Drying and pre-heating

Chambers 6 and 7---- Burning

Chambers 8 to 11----- Cooling

Chamber 12---------- Unloading.

With the above arrangement, the circulation of the flue gas will be as shown by arrows in fig. 4-7. The cool air enters through chambers 1 and 12 as their main doors are open. After crossing the cooling chambers 8 to 11, it enters the burning section in a heated condition. It then moves to chambers 2 to 5 to dry and pre-heat the raw bricks. The damper of chamber 2 is in open condition and hence it escapes into atmosphere through chimney. The initial cost of installing this kiln is high,

8. Write the comparison between clamp burning and Kiln burning. 8

No	Item	Clamp Burning	Kiln Burning
1	Capacity	About 20000 to 100000 bricks can be prepared at a time	Average 25000 bricks can be prepared per day
2	Cost of fuel	Low as grass, cow dung, litter, etc. may be used	Generally high as coal dust is to be used.
3	Skilled supervision	Not necessary throughout the process of burning.	The continuous skilled supervision is necessary
4	Initial cost	Very low as no structures are required	More as permanent structures to be built.
5	Quality of bricks	The percentage of good quality bricks is small about 60% or so	The percentage of good quality bricks is more about 90% or so.
6	Regulation of fire	It is not possible to control or regulate fire during the process of burning.	The fire is under control throughout the process of burning
7	Structure	Temporary structure	Permanent structure
8	Suitability	Suitable when bricks are to be manufactured on a small scale and when the demand of bricks is not continuous	Suitable when bricks are to be manufactured on a large scale and when there is continuous demand of bricks.
9	Time of burning and cooling	It requires about 2 to 6 months for burning and cooling of bricks	Actual time for burning of one chamber is about 24 hours and only about 12 days are required for cooling of bricks.
10	Wastage of heat	There is considerable wastage of heat from top and sides and hot flue gas is not properly utilized.	The hot flue gas is used to dry and pre-heat raw bricks. Hence the wastage of heat is the least.

SECTION -III

(Cement, Aeriated concrete blocks, Tiles, Glass)

1. Functions of ingredients of Cement. 6

The cement. contain two basic ingredients. 01. Argillaceous material 02. Calcareous material.

In argillaceous material clay predominant and calcareous material calcium carbonate predominant

A typical Chemical composition of Portland cement is as fallows.

Sl No	Ingredient	Percentage
1	Lime (CaCo3)	62
2	Silica (SiO_2)	22
3	Alumina ($A1_203$)	05
4	Calcium Sulphate (CaSO4)	04
5	Iron Oxide (Fe_203)	03
6	Magnesia (MgO)	02
7	Sulphur (S)	01
8	Alkalis	01
	Total	100

1. Lime: It is an important ingredient of cement which gives strength for the cement. The lime added in excess make the cement expand and disintegration of cement.

2. Silica: It gives strength to the cement in the form of Dicalcium silicate and Tricalcium silicate if silica is present in excess the setting time will be increased.

3. Alumina: It gives quick setting property to the Cement excess of alumina weakens the cement.

4. Calcium sulphate! It is added in the form of Gypsum it gives initial setting time to the cement.

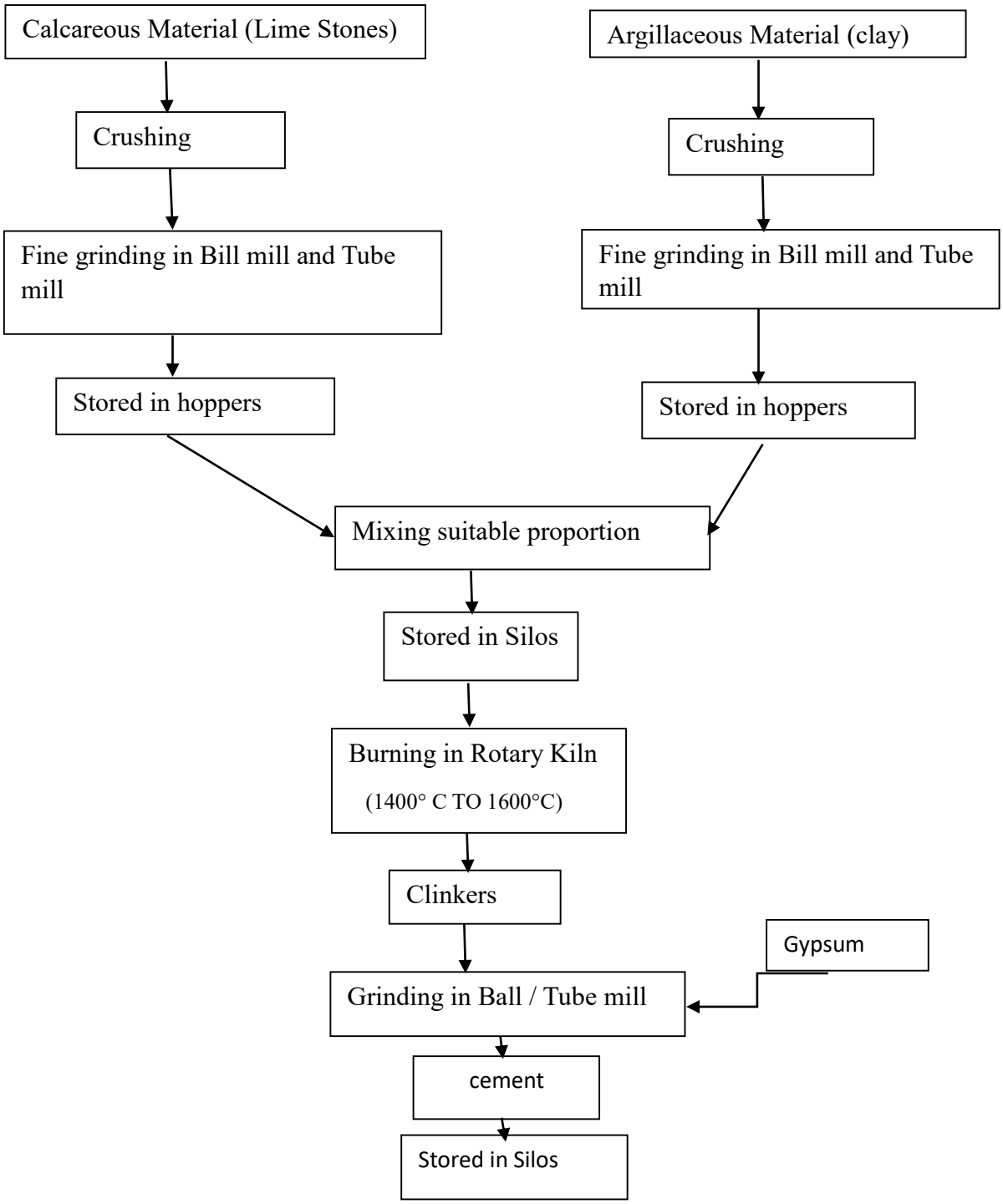
5. Iron oxide: It gives strength, Colour, Hardness to the Cement.

6. Magnesia: It gives hardness and colour due to the cement.

7 Sulphur: It gives soundness property to the Cement.

8.Alkalies; It is a undesirable substance present in the raw material, most of the alkalis will be get burnt out during burning of the cement. If the alkalis are present more than it Causes number of problems. Such as Efflorescence, white patches ect…

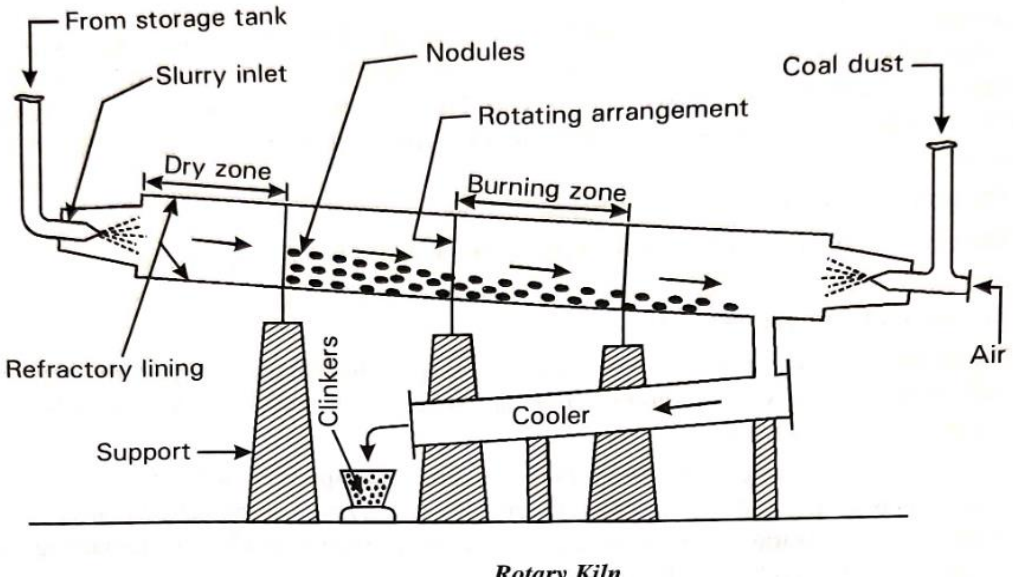
2. Explain with flow diagram Dry process of manufacture of cement. 7



- In this process the Calcareous material such as lime Stone, and Argillaceous material such Clay is crushed in the Crusher to reduce size less the 25mm.
- A current of dry air is also been passed over these materials to dry them completely.
- The crushed materials are grinded in Ball mill and tube mill. These operations are done separately for each raw material and the grinded materials are stored separately in hoppers.
- These two Materials are mixed in suitable proportion and stored in the silos. which is ready for next operation called burning.
- The burning is carried out in Rotary kiln where the material are burnt in temperature of 1400°c to 1600°C at that temperature calcination reaction takes place and clinkers are formed

- The clinkers obtained from Rotary kiln are grinded in Ball mill and Tube mill. During grinding a small quantity of gypsum is also added. The grinding operations gives cement which is stored in the silos after that sent for packing & sailing.

3.Explain with neat sketch burning process in Manufacture of cement. (Rotary Kiln) 10



Rotary Kiln

Construction:

- The Rotary kiln is consisting of steel tube of diameter 2 to 3m and length is about 90 to 100m.
- The steel tube is laid in a slope of about 1 in 20 to 1 in 30. The kiln is supported by columns at intervals.
- The columns are made from concrete or brick masonry.
- A refractory lining is also provided inside the surface of Rotary kiln to prevent escape of heat.
- Arrangement is made in such a way that the Kiln can be rotated about its Longitudinal axis. The speed of rotation is about 2 to 3 RPM.
- Provision is made to insert raw materials from Upper end and Fire from the lower end of the kiln.

Working:

- When the Raw materials comes in contact with Dry zone the water from the material is evaporated.
- In the next zone the carbon dioxide from the material is evaporated and materials get converted in to Nodules.

- These Nodules when comes in contact with Burning zone at temperature of about 1400 to 1600C Calcination reaction takes place and Nodules are get converted in to Clinkers.

- The size of clinker is about 3mm to 20mm. they are very hot and Hard. Hence, they are cooled in cooler before collected in to container.

4.List the different types of cement and their uses. 10

1. Ordinary Portland Cement
2. Rapid Hardening Cement
3. Slag Cement
4. Quick setting Cement
5. Portland Pozzolana Cement
6. Low Heat Cement
7. Sulphate Resisting Cement
8. White cement
9. Coloured Cement
10. Hydrophobic cement
11. High Alumina Cement

1.Ordinary Portland Cement (OPC):

- It is most important type of cement widely used for all general construction works.
- It is available in 3 Grades such as 33Grade, 43 Grade and 53 Grade. Having the compressive strengths of 33N/mm^2,43N/mm^2 and 53N/mm^2 respectively.
- High grade cements manufactured by increasing C_3S and fine grinding of clinkers.
- **Uses:** Used for genral construction works such as Residential buildings public building structural elements like Beam, Column, Staircase, Lintel, Slab, Footings, ect…

2. Rapid Hardening Cement:

- This cement gives early strength at early days.
- By using this cement 28 days strength of OPC is obtained within 7 Days. 7 Days strength of OPC can be obtained within 3 Days
- This cement is manufactured by increasing the percentage of C_3S and decreasing the percentage of C_2S
- **Uses:** Used in Factories to prepare precast products such as Electric poles, Railway sleepers, Pipes ect.Used in Road repair work, when structures are to be put in to use at early days. When cantering support is required to be removed in early days.

3.Slag Cement:

- This cement is obtained by mixing and grinding the Portland cement clinkers with slag in suitable proportion. The slag is waste product obtained from Blast furnace.
- This cement has high resistance to chemicals. It's very cheap and economical.
- **Uses:** This cement can be used wherever the OPC is used. Due to its resistance to chemicals used in Marine structures, Municipal sanitary works, Sewers, sewage treatment plants. Ect…

4.Portland Pozzolana Cement (PPC):

- This cement is obtained by grinding a mixture of 60% Portland cement clinkers with 40% Pozzolanas such as Fly ash, Volcanic ashes.

- This cement has resistance to chemicals and sulphates
- **Uses:** This cement can be used wherever the OPC is used. Due to its resistance to chemicals used in Marine structures, Municipal sanitary works, Sewers, sewage treatment plants. Mass concrete works etc…

5.Quick setting Cement:

- This cement sets quickly, within 5 minutes it become hard like stone.
- This cement is manufactured by increasing the percentages of C3S and decreasing the percentage of C2S.
- Uses: It is used for under water concreting, and cold places.

6. Low heat Cement:

- This cement is manufactured by decreasing the percentage if C3Sand increasing the percentage of C2S.
- This cement has less heat of hydration when compared to OPC.
- It has low initial strength but final strength is same as that of OPC.
- Uses: Used in Mass concrete works such as Bridges Dams Culverts ect…

7.Sulphate resisting Cement:

- The sulphate reacts with Alumina content of cement and form Sulphoaluminate compound which get expand and causes disintegration of cement.
- Sulphate resisting cement is manufactured by reducing the percentages of C_3A and C_4AF. These two compounds are kept less than 5%. So that formation of sulphoaluminate compound can be minimised and cement become resistant to sulphate attack.
- **Uses:** Sulphate resisting cement is used in the construction of Marine structures, Concrete pipes buried in Marshy areas, and Construction of sewage treatment plants, waste water treatment plants.

8.White cement:

- It is white in colour it is manufactured same way as that of OPC but the raw materials of purest forms are used and fuel used for burning of this cement is Oil or gas.
- This cement is free from colouring substance.
- This cement is very costly when compared to OPC

Uses

a) For pointing of stone masonry, wall and floor tiles fixing, marble fixing

b) Manufacture of terrazzo and mosaic floorings.

c) White washing the walls.

d) Manufacture of floor tiles.

e) Manufacture of cement paints.

9.Coloured cement

Coloured cement consists of OPC with 5 to 10% of colouring pigment. Cement of desired colour may be obtained by mixing colouring materials with ordinary cement.

Green colour----- Chromium oxide

Blue-----Cobalt

Brown--- Iron oxide

Uses: The coloured cement are widely used for finishing of floors, external surfaces, artificial marble, stair treads, etc.

10. High alumina cement

- The raw materials used for the manufacture of high alumina cement are limestone and bauxite.
- The initial setting time of this cement is more than 3½ hours. The final setting time is about 5hours. It therefore allows more time for mixing and placing operations.
- It can stand high temperatures.
- It resists the action of acids in a better way.
- It sets quickly and attains higher ultimate strength in a short period.

Uses: Used in chemical plants and furnaces.

Used in colder regions having temperatures 18°C or below

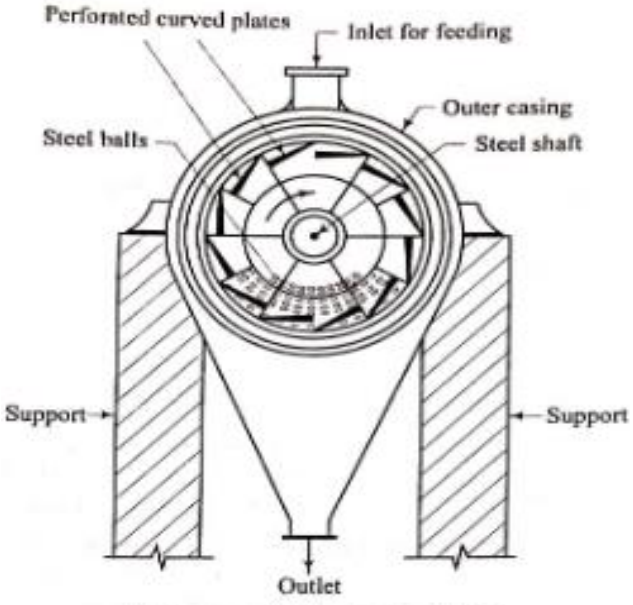
OR

Cement	Property	Uses
1.Ordinary Portland Cement	It is available in 3 Grades such as 33Grade, 43 Grade and 53 Grade. Having the compressive strengths of 33N/mm^2,43N/mm^2 and 53N/mm^2 respectively	Used for general construction works such as Residential buildings, public building, structural elements like Beam, Column, Staircase, Lintel, Slab, Footings, ect…
2.Rapid Hardening Cement	This cement gives early strength at early days.	Precast products such as Electric poles, Railway sleepers, Pipes ect. Used in Road repair work, When structures are to be put in to use at early days. When cantering support is required to be removed in early days.
3.Slag Cement	This cement is obtained by mixing and grinding the Portland cement clinkers with slag in suitable proportion high resistance to chemicals. It's very cheap and economical.	used wherever the OPC is used. Due to its resistance to chemicals used in Marine structures, Municipal sanitary works, Sewers, sewage treatment plants.
4.Quick setting Cement	This cement sets quickly, within 5 minutes it become hard like stone.	It is used for under water concreting, and concreting in cold places

5.Portland Pozzolana Cement	obtained by grinding a mixture of 60% Portland cement clinkers with 40% Pozzolanas such as Fly ash, Volcanic ashes. Resistance to chemicals and sulphates	Marine structures, Municipal sanitary works, Sewers, sewage treatment plants. Mass concrete works
6.Low Heat Cement	This cement has low heat of hydration when compared to OPC. Manufactured by decreasing the percentage if C_3S and increasing the percentage of C_2S.	Used in Mass concrete works such as Bridges Dams Culverts
7.Sulphate Resisting Cement	This cement is manufactured by reducing the percentages of C_3A and C_4AF.	Marine structures, Concrete pipes buried in Marshy areas, and Construction of sewage treatment plants, waste water treatment plants.
8.White cement	The raw materials of purest forms are used and fuel used for burning of this cement is Oil or gas.	For pointing of stone masonry, wall and floor tiles fixing, marble fixing Manufacture of terrazzo and mosaic floorings. White washing the walls. Manufacture of floor tiles. Manufacture of cement paints.
9.Coloured Cement	Obtained by mixing colouring materials with ordinary cement. Green colour----- Chromium oxide Blue-----Cobalt Brown--- Iron oxide	widely used for finishing of floors, external surfaces, artificial marble, stair treads, etc.
10. High Alumina Cement	It can stand high temperatures. It resists the action of acids in a better way. It sets quickly	Used in chemical plants and furnaces. Used in colder regions having temperatures 18°C or below

3. Explain grinding of cement using Ball mill with neat sketch. 10

Ball Mill:



Vertical section of a ball mill

Construction:

- Ball mills are used for Preliminary grinding of materials and Tube mills are used for Fine grinding of materials.
- The Ball mill consist of a steel cylinder of diameter 2 to 2.5m and length about 2m.
- The cylinder is placed in horizontal position and it is supported by pillars.
- The provision is made in such a way that steel tube can be rotated about inner shaft.
- Inside the surface of steel tube perforated curved plates are fixed, the ends of these plates are overlap on each other.
- The steel tube is partially filled with steel balls of size 50mm to 120mm

Working:

- The materials to be grinded is fed from top.
- When the cylinder is rotated about its central shaft the steel balls strike against each other and with perforated plates in doing so materials get crushed in to powder form.
- The powder is passed through inner sieve before collected from outlet.

6. Name the different types of tiles used for flooring and explain anyone. 6

In India, the red oxide concrete floors were very common long ago. They were slowly replaced by Terrazzo floors/Mosaic floors & now by marble and other stone floors.

Nowadays, large types of ceramic and vitrified tiles are becoming more and more popular especially due to the ease with which these can be placed and also maintained.
Some of the tiles commonly used are:

1.Mosaic tiles	2.Glazed tiles
3.Ceramic tiles	4.Vitrified tiles
5.Earthenware tiles	6.Stoneware tiles
7.Terracotta tiles	

Following are the advantages of Vitrified tiles OR Ceramic tiles

- They are available in many colours.
- They can be easily laid because they are light in weight
- They are lighter than granite, marbles or mosaic tiles.
- They are scratch proof, stain proof and damp proof
- Maintenance cost is very less.
- They do not require polishing and the floor is ready to use very next
- They are available in mat finish, Glazed finish type.
- These tiles can be easily repaired and replaced
- These files have zero water absorption hence they Can be used for bathrooms, kitchen and washrooms
- They resemble granite and offers great variety of finishers in terms of colour and design options.
- They can be used for homes and offices.

Disadvantages

- These files generally costly.
- The surface Slippery on becoming wet.

7. List the properties and uses of Aeriated concrete blocks. 10

Aerated concrete blocks are very light as compared to bricks, stone and dense concrete blocks. They contain numerous tiny air pockets, resulting in smaller mass and other desirable properties. Aerated concrete is used in the construction of external walls, internal walls, foundations and suspended concrete floors.

The blocks are manufactured from sand, lime, pulverised fuel ash (PFA) and cement. Aluminium powder is added to the mix, which reacts with cement to form bubbles of hydrogen gas. The mix expands and hardens to form a cake, which is then cut into blocks. The next stage is to steam-cure the blocks, under high pressure. The blocks are light grey in colour and have a texture that is suitable for most types of plastering or rendering.

The nominal dimensions of a concrete block should be:

400X100X200

500X150X250

600X250X300

Properties of Aerated Concrete Blocks

a) Appearance:

The blocks are light grey in colour and have a rough texture that is suitable for most types of plastering or rendering.

b) Sound Insulation and Acoustic Control

An excellent material for soundproofing material and acoustic insulation. A large number of air voids inside the blocks offers good sound and thermal insulation. The average sound-reduction index of 100mm thick blocks with lightweight plaster is 40 decibels (dB). It is used for the construction of walls in auditorium, hotels, studios, hospitals etc.

c) Fire Resistant

Aerated concrete blocks are classified as non-combustible. Blocks that are 100 mm thick provide fire resistance of 2 hours and 4 hours for load-bearing and non-load-bearing elements, respectively.

d) Durability

Aerated concrete blocks do not rot or decay and are resistant to freeze-thaw cycles. They have good resistance to sulphate attack.

e) Pest Resistant

The materials used to make blocks are inorganic, which helps preventing/avoiding pests like termites.

f) Earthquake Resistant

The light weight property of blocks makes it an ideal construction material in earthquake prone areas.

g) Faster Construction

Aerated concrete blocks are lightweight building units that can be safely and repetitively handled by a single person. They can be easily and accurately cut with wood working tools, minimising the generation of solid waste. Easy to cut for chases and holes for electrical and plumbing lines. Apart from that, the blocks come in large sizes, so have fewer joints which ultimately results in faster construction.

h) Cost Saving

Aerated concrete blocks are not only lighter than red bricks but also cheaper than the red bricks.

Uses of Aerated Concrete Blocks

- These blocks are used as load bearing and non-load-bearing internal walls, partition and panel walls, cavity walls,
- Reduction of dead load, faster building construction and lower haulage and handling costs.
- used for making sound insulation panels,
- Filtering media and floating blocks for fishing purposes.
- Aeriated block masonry may not require plastering for unimportant buildings.

SECTION-IV

(Ferrous metals, Nonferrous metals, Alloy, Paint, POP, Glass, FRP)

1. What are the properties and uses of Cast Iron **10**

Properties of Cast Iron

- Cast iron contains about 2 to 4% of carbon
- It cannot be magnetized.
- It does not rust easily.
- It becomes soft when placed in salt water.
- It can be hardened by heating and sudden cooling but cannot be Tampered.
- It is fusible hence it is used in diecasting work.
- It is hard, but it is brittle.
- It is not malleable and ductile.
- Its structure is granular and crystalline with whitish or greyish tinge.
- It cannot be useful for forging work because of lack of plasticity
- Specific gravity is 7.5.
- Melting point is about 1250^{o}C.
- It shrinks on cooling.
- It is weak in tension and strong in compression.
- Two pieces of cast iron cannot be connected by process of welding or riveting.

Uses of Cast Iron in Building Construction

- For making Underground water pipes, gas pipes, sewers, man hole covers and sanitary fittings.
- For making ornamental castings such as gates, lamp posts, spiral staircase.
- Metal columns and column bases can be made using cast iron.
- Rail chairs and carriage wheels are manufactured.
- For preparing agricultural implements.
- Used for making Machinery parts which are not subjected to shock load

2. Write the properties and uses of steel **5**

Properties of mild Steel

- Mild steel contains about 0.1 to 0.25% of carbon.
- It can be Magnetized Permanently
- It is malleable and ductile material
- It rusts rapidly
- It is not affected by salt water.
- It is tougher and stronger than cast iron.
- It has fibrous structure,
- Its melting temperature is about 1400 C
- Its specific gravity is about 7.8.
- It cannot be hardened by heating and sudden cooling but can be tampered.

Uses of Steels

- Motor body making
- Rails of railway track
- Boiler plates
- Structural steel work such as c-section, I section, Channel section etc.
- Used for making GI sheets corrugated roofing sheets.

3. What are the properties and uses of Aluminium **10**

Properties of Aluminium

- It is a very good conductor of heat and electricity.
- It is a silvery white metal with bluish tinge and exhibits bright lustre on a freshly broken surface.
- It is a non- magnetic substance.
- It is highly resistance to corrosion.
- It is light in weight, malleable and ductile.
- It is very soft.
- Melting point is about 660^{o}C, Boiling point is 2056^{0}c.
- Specific gravity is 2.7

Uses of Aluminium

- Used for making parts of Aeroplane cooking utensils.
- Window frames, sheets, structural members.
- Making aluminium alloys, automobile bodies, surgical instruments, Engine parts.
- Manufacture of paints in powder form.
- Manufacture of electrical conductor.

4. What are the properties and uses of Copper **10**

Properties of Copper

- It becomes brittle just below the melting point.
- It has a peculiar reddish-brown colour.
- It is a good conductor of heat and electricity.
- It can be worked in hot or cold condition, but cannot be welded.
- It is malleable and ductile.
- It is very soft.
- Melting point is about 1083^{o}C, Boiling point is 2300^{0}c.
- Specific gravity is 8.92

Uses of Copper

- Used for Electric cables, alloys.
- House hold utensils,
- Electro plating
- Dowels in stone masonry.
- Lighting conductors

5. What is alloy name different types of alloys and explain anyone. **10**

Alloy: Alloy is an intimate mixture of Two or more metals. Example Aluminium alloys,

Copper alloys, Steel alloys,

Aluminium alloys: Following are the important Aluminium alloys of Aluminium.

1. Duralumin
2. Aldural
3. Y-Alloy

1.Duralumin: It is the most important alloy of Aluminium. It consists of following metals.

Aluminium	= 94%
Copper	= 04%
Iron	= 0.5%
Manganese	=0.5%
Magnesium	=0.5%

- Duralumin is strong, Hard and Durable metal.
- It possesses property of age hardening. It acquires full strength within period of 2-3 days after manufacturing.
- It is good conductor of heat and electricity.
- Uses: Used in the manufacture of Aeroplanes and aircrafts,
  Automobile industry,
  Electrical cables,
  Surgical instrument,
  Electronic Gadgets such as Mobiles, Laptops,
  Household Utensils.

2.Aldural:

It is actually Duralumin but coated with thin coating of pure Aluminium. The thickness of pure aluminium is about 5%. The layer prevents corrosion due to salt water.

3. Y-Alloy: Following is the composition of Y-Alloy.

Aluminium=92.5%

Copper=04%

Nickel=02%

Magnesium= 1.5%

This alloy is a good conductor of heat and it possess high strength at high temperature; hence it is used for making Engine parts, Gear box, Cylinder heads, Propeller bladers etc.

6. What are the Characteristics of a good paint 5

1.It should possess good spreading power so that small quantity of paint can cover large area.

2.Paint should be cheap and economical.

3.Paint should be easy to apply.

4.The paint should dry in reasonable time and not too rapidly.

5.Paint should maintain its colour for long time.

6.Paint should provide hard and durable surface.

7.Paint should not affect on health of person during its application.

8.It should provide attractive and pleasing appearance.

9.Paint should be free from defects such as Cracking, Blistering Flaking Sagging etc.

10.Paint should provide thin film of uniform nature.

7. Write the ingredients of oil paint with their functions. 8

Following are the ingredients of oil paint

1. Base
2. Vehicle
3. Drier
4.Colouring pigment
5.Solvent

1.Base: Base is solid substance added to paint in fine powder form.

It serves following functions in paint

- It increases the Bulk or volume of paint and reduce the cost of paint
- It makes the painted surface hard strong and durable.
- It prevents shrinkage of paint during drying.
- It makes the paint opaque.

Following are the various bases used in the paint.

White lead, red lead, Iron oxide, Titanium white, Aluminium powder.

2.Vehicle: Vehicles are liquid substances added in the paint which serve following two purposes.

- It holds the ingredients of paint in liquid suspension
- Spread the ingredients evenly when paint is applied over the surface.

Following are the various Vehicles used in the paint.

Linseed oil, Tung oil, Nut oil, and poppy oil

3.Driers: These are substances which accelerate the process of drying. A dryer absorb oxygen

from atmosphere supply it to vehicle. Example: Litharge, Red lead, Sulphar, Manganese.

4.Colouring pigments: Following Colouring pigments are added to get desired colour,

Black colour—Graphite, Lampblack

Blue colour-------Indigo, Percian blue

Green------Chrome green, Copper sulphate

5.Solvent: The function of solvent is to make paint thin so that it can be easily applied over the surface and it also help paint to penetrate deeply inside the surface. Commonly used solvent is Turpentine.

8. Explain the process of painting on new wood work. 10

Normally four coats of paint are applied for new wood work. The process of painting is carried out as follows.

1)The surface of wood is prepared to receive the paint. For satisfactory working, it is necessary that wood work is fully seasoned, and it should not contain more than 15 percent moisture at the time of painting. The surface is cleaned and heads of nails are punched to a depth of 3mm below the surface.

2) The surface of the wood is then knotted.

3) The priming coat is then applied on the surface of new wood work.

4) The process of stopping is then carried out. That is rubbing the painted surface with sand paper or pumice paper is done.

5) The subsequent coats of paint, namely under coat and finishing coats are applied on the surface. Extreme care must be taken to see that finishing coats gives smooth and even surface and no brush marks are seen on the surface.

9.Explain the defects in paint 5

Following are the usual defects which are found on the painting work.

1. Blistering: This defect is formed due to water vapour which is trapped behind the painted surface.

In this defect bubbles are formed under the film of paint. It is usually caused due to painting on unseasoned wood.

2.Fading: The gradual loss of colour is known as fading. It is mainly due to effect of sun light on paint

3.Flaking: A small portion of painted surface is some times seen loose. It is due to poor adhesion.

4.Running: The paint runs back and leave small area un covered called running. Caused due to painting on too smooth surface.

5.Sagging: When vertical or inclined surface is too thickly painted, the defect of sagging occurs.

6.Wrinkling: When horizontal surface is too thickly painted wrinkles on painted surface are formed.

7.Bloom: Formation of dull patches on finished surface is called bloom. It is due to bad ventilation.

8.Flashing: some time glossy patches are seen on the painted surface known as flashing. It is mainly due to poor workmanship or poor-quality paint.

10.Explain different types of glasses and their use. 10

1.Soda Lime Glass:

- It is also known as Soda glass. It is mixture of Sodium silicate and Calcium silicate.
- It is cheap and economical.
- It is available in clean and clear state.
- It is Fusible material and can be moulded in to desired shape and size.
- The pieces old soda glass can be welded by method of fusion.
- Uses: Window glass, Plate glass, Manufacturing of glass bottles, Laboratory apparatus.

2.Potash Lead Glass:

- It is a mixture of Potassium silicate and Lead silicate.
- It is popularly known as Flint Glass.
- It has great refractive power
- It is a fusible material and can be moulded in to desired shape and size
- It is easily affected by Alkalis.
- It became Black when it come in contact with reducing gas mixture.

Uses: Used in the manufacture of Gems and Diamonds. Lenses, Prisms, Electric Bulbs etc.

3.Common Glass:

- It is popularly Known as Bottle glass.
- It is a mixture of Sodium Silicate, Calcium silicate, & Iron silicate.
- It is not available in clean and clear state.
- It is not heat resistance
- It is available in different colours.
- It is easily affected by acids and alkalis.

Uses: It is used in the manufacture of Medicinal bottles, Liquor bottles

4.Borosilicate Glass:

- It is a mixture of Boric oxides and Silica.
- It is Heat resisting Glass, popularly known as oven ware.
- It is not affected by acids or alkalis.
- It is available in clean and clear state.
- It can resist change in temperatures.

Uses: Used in Laboratory apparatus, Chemical industry, FRP Pipes and FRP products

11.Explain the properties and uses of FRP 10

Properties:

1. FRP are made from two materials to form a composite material of different properties.
2. Plastic which is reinforced with Glass fibres are called as FRP/GRP
3. It is also called as GRP (Glass fibre Reinforced Plastics).
4. Glass fibre gives strength, stiffness, stability while Plastic (Resins) transfer load to the glass fibre.
5. It became boon to construction industry due to extensive use.
6. It is also used in other industries such as Fertilizer, Food industry Oil and gas industry and Textile industry.
7. It is available in super finish with eye catching appearance.
8. FRP are resistant to corrosion, chemicals and acids.
9. FRP are dimensionally stable maintain its shape under mechanical and Environmental stress.
10. It is easy to repair the damaged portion of FRP
11. FRP products are inorganic and non-biodegradable, used to store Food and its product for long period of time.
12. Less energy is required to manufacture FRP products. It requires about $2/3^{rd}$ energy required to manufacture steel and only 1/3 of energy required to manufacture Aluminium.

13. FRP can be moulded in to desired shape and size.
14. FRP are light in weight when compared to steel structure which results in reduction in dead weight.
15. Maintenance cost is less as it does not require protective coat of paint.

Uses of FRP:

1. Used for concrete shuttering and cantering.
2. Used to make Domes for industrial and commercial buildings They are self-supporting and need less supports
3. Used for making Doors and Windows
4. Used in internal partition walls in industrial and commercial buildings. Also used in False ceiling and wall panelling.
5. Used for Roofing sheets, Sky lights as they are available in transparent form.
6. Used as structural sections in place of steel sections.
7. Used for making temporary shelters, Watch man cabins, Vehicle parking shelters, green house, Project offices etc.

12. Write the advantages of PVC pipes. 5

1.They are good insulators of heat, hence the temperature of water passing in the pipe is not affected by the outside temperature.

2. They permit smooth and undiminished flow of water.

3. These pipes do not have problem of incrustation.

4. It possess high Hazen's Williams constant; it results in to adoption of smaller size pipe.

5. They are cheap and economical when compared to GI pipes.

6. These pipes does not corrode and have high resistance to various chemicals.

7. These pipes can be easily fixed by Gluing does not require threading.

13.What are the properties and uses of plaster of Paris. 10

Properties

1. The Plaster of Paris is obtained by heating pure Gypsum @ temperature of about 120-160^{0}C.
2. When plaster of Paris powder is mixed with water, the powder form plastic mass and hardens quickly within 5 to 15 minutes.
3. The setting action of Plaster of Paris can be accelerated by adding alkali sulphates like alum.
4. To get smooth surface inside the building plaster of Paris mixed with water and applied over the cement plaster.
5. The specific gravity of POP is 2.57
6. Plaster of Paris is usually available in white powder form.
7. It can be easily worked with thin metal sheet, and shaping by rubbing with sand paper.
8. POP is not so strong it requires external support.
9. POP is easily affected by water hence it is not used in exterior surfaces & bath room.
10. It is fire resistant and non combustable
11. Low chemical reactivity

Uses:

1. Used for false ceiling
2. Used to fill the cracks and holes on the plastered surface.
3. Used for making ornamental statues, Toys
4. Used for ornamental casting and decorative material.
5. Used to fill small gaps and cracks on walls and roof.
6. Used to protect tiles and other flooring materials during construction work.
7. Used as fire proofing material.
8. Used in hospitals for Bone fracture and sprain.
9. Making smooth surface.