

# CBCS SCHEME

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18CV643

## Sixth Semester B.E. Degree Examination, July/August 2022 Alternative Building Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. List the four categories of energy consumption in a building and explain them. (10 Marks)  
b. Explain energy in building materials illustrate content in one Burnt brick. (10 Marks)

OR

- 2 a. List out various environmental friendly and cost effective building technologies. Explain any one in brief. (10 Marks)  
b. What are the advantages of LEED? List out five main credit categories in L - E - E - D rating system. (10 Marks)

### Module-2

- 3 a. Discuss the characteristics of table module bricks and laterite building blocks used for wall construction. (10 Marks)  
b. Explain the concept of stabilized Mud block. (S.M.B). (10 Marks)

OR

- 4 a. List the properties of good mortar and explain any two in detail. (10 Marks)  
b. A brick masonry prism is made of 6 bricks jointed by mortar of thickness 2cms. The brick is 8cm in thickness. The prism is subjected to uniform vertical stress of 5MPa. The brick has a modulus of 800MPa and mortar has a modulus of 9000MPa. Determine the horizontal lateral stress in the brick and mortar. Assume Poisson's ratio of brick and mortar = 0.1. (10 Marks)

### Module-3

- 5 a. Name different types of Pozzolona material. Explain any two in detail. (10 Marks)  
b. Write a note on : i) Metallic fiber ii) Natural fiber. (10 Marks)

OR

- 6 a. List the agro wastes and mention it application in the building construction. (10 Marks)  
b. What are different industrial wastes used effectively in construction industry. Explain any 3 materials. (10 Marks)

### Module-4

- 7 a. What are primary functions of a roof? Explain briefly the various roofing alternatives. (10 Marks)  
b. What are the materials used in Ferro cement? Explain the construction method in brief. (10 Marks)

OR

- 8 a. Explain composite masonry and cavity wall masonry. (10 Marks)  
b. Write advantages and disadvantages of MiVan construction. (10 Marks)

### Module-5

- 9 a. What are the advantages and disadvantages of manufacturing concrete from R.M.C plants? (10 Marks)  
b. What is meant by precast elements? What are the advantages of precast elements? (10 Marks)

OR

- 10 a. Write an note on : i) Type of concrete mixers ii) Cost concepts in building. (10 Marks)  
b. What are the equipments used for producing stabilized blocks? Explain then in brief. (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

# Alternative Building Materials.

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## Module - 1.

Q1. List the four categories of energy consumption in building and explain them.

Sol: Different categories of energy consumption in a building:

- a) Embodied energy in building materials
- b) Energy consumption during building construction
- c) Energy utilized for maintenance during the life span of a building
- d) Energy spent in demolition of the building at the end of its life.

The four categories of energies constitute the life cycle energy cost of the building. The energies (a) & (b) together will constitute the energy spent in transporting materials to site, energy spent in hoisting materials/Water and energy spent to carry out concrete mixing, floor polishing. In (c) refers to the energy spent to meet the needs of the occupant of a building by using electrical energy. The electrical energy may be used in lighting, air conditioning, water pumping and operation of elevators. In residential buildings there are other types of energy expenditure. Use of ovens, water heaters, TV and entertainment electronics are the other users in buildings.

Q1.6. Explain energy in building Materials illustrate content in one Burnt brick.

Sol. The primary use of energy in building Materials is in the Production of the building Materials. Eg. Bricks and tiles are produced by burning coal or fire wood in kilns. Cement and lime are again produced by heating clay and limestone using coal. Steel is also produced by using coking coal as the fuel. Basic energy in all these cases is in the form of thermal energy.

Eg. Energy in brick is calculated by determining the amount of firewood or coal used for brick burning. In south India, one brick needs 0.25 to 0.30 kg of wood for energy. Assuming an energy value of wood of 15 MJ per kg we get an energy content in the range of 3.75 - 4.5 MJ

OR.

Q2.a. list out various environmental friendly and cost effective building Technologies. Explain any one in brief.

Sol. 1) Transportation of building Materials to the construction site contribute to the cost and embodied energy of a building. If sandy soils are available locally, stabilization of the soil by lime and cement can easily produce a mortar with a strength of 2 MPa

2) Use of stone (size stones or random rubble) is quite common in South India for foundation of walls.

Use of soil-cement or soil lime cement as Mortar should be cost effective alternative. Use of arched foundation is also an cost effective alternative.

- 3) Wall construction can be cost effective, if finish of the masonry unit is good, so as to eliminate plastering. Good quality Stabilized Mud block (SMB) or Hollow Concrete Block (HCB) can be used for wall. Use of Cement-soil-sand Mortar is also cost effective compared to cement mortar without sacrificing masonry strength and durability.
- 4) Energy efficient roofing alternatives can be considered. Use of partial or complete prefabrication can lead to efficient use of materials. In Jack Arch roofing, expensive concrete is partially replaced by brick masonry.
- 5) Use of filler slab, where the tension zone concrete is partly replaced by SMB or brick is also cost and energy efficient.
- 6) Use of brick and domes/Vaults can lead to roofing systems which reduce penetration of solar heat into the building. Reduction in the steel used facilitates reduction in the embodied energy in the building.

Q26. What are the advantages of LEED? List out five main categories in LEED rating system.

Sol. Advantages -

1. Improved Indoor Air quality.
2. Promote Better Health.

3. Improved Workforce
4. Fosters Public Relations
5. Money Saving
6. Faster to obtain Green goals

## Main Categories of LEED Rating system

1. Sustainable Sites (SS) - Developing and integrating the design of the building with the ecological and environmental aspects of the site
2. Water Efficiency (WE) - Reducing water usage in a building immediately impacts the environment and results in both water and money savings.
3. Energy and Atmosphere (EA) - Efficient use of energy in buildings lowers operating costs and reduces green house gas emissions
4. Materials and Resources (MR) - Recycling building materials recovered during construction keeps them out of landfills and leads to less destruction of natural habitats and resources
5. Indoor Environmental Quality (IEQ) - Monitoring indoor environmental quality ensures the comfort and well being of installers during the building process as well as team members and guests when stores open.
6. Innovation & Design Process - Provide building operations, maintenance, upgrade teams with the opportunity to achieve additional environmental benefits.

## Module-2

Q3a Discuss the characteristics of table Module bricks and laterite building blocks used for wall construction.

- Sol:- In Laterite Building blocks -  
It is found in coastal districts of Karnataka.
1. It is soft when excavated but hardens, on drying and hardening is irreversible.
  2. It is durable, it is been used extensively in Bidar fort. Not very strong Material, but show average strength of 1.7 MPa.
  3. Maximum compressive strength ranges from 1.04 MPa to 3.47 MPa. Average strength must be 3.5 MPa as per BIS code
  4. Block thickness of more than 190 mm is used. for developing of strength of 2.0 - 2.5 MPa. It is desirable to avoid block of strength lower than 2 MPa.

In Table Moulded Bricks -

1. Five sided mould is used to shape a relatively stiffer mud into a brick.
2. The use of lesser moisture at the time of moulding leads to an improved shape and strength for brick. The wet brick is released by turning the mould upside down on a level platform. These bricks have a frog on one of the bedding face.
3. These Bricks are dried in shade and then burnt in continuous kiln known as Bull's Trench Kiln

4. Table moulded brick is generally much stronger than the country brick.
5. strength ranging from 3.5 MPa to 7.0 MPa for table moulded Bricks.

Q36. Explain the concept of stabilized Mud Block (SMB)

Sol. When soil is compacted using external energy, the density of the soil reaches a maximum value at a moisture content known as the optimum moisture content (OMC). The value of OMC and the maximum density depends on the energy input during compaction. The compressive strength of the soil in the dry state depends on the density. Thus the process of Mechanical compaction can lead to densification and strengthening of the soil. The soil can also be stabilized against loss of strength during saturation, a stabilized (soil) mud block where the stabilization is achieved by a combination of densification and mixing of a stabilizing additive. A variety of materials can be used for stabilization namely lime, cement and bitumen.

OR

Q37a. List the Properties of good Mortar and explain any two in detail.

- Sol.
1. Mortar should be water resistant
  2. Deformability of Mortar should be low
  3. Mortar should be cheap
  4. Mortar should be easily workable in the site condition.
  5. The Mobility of Mortar should be good.

6. It should Possess high durability
7. To improve the speed of construction, good mortar should set quickly.
8. Cracks should not be developed in the joint formed by mortar. It is desirable to last for long period of time without losing the appearance.

### Strength of Mortar

Compressive strength of Mortar is related to the masonry strength. Increase in the mortar strength does not significantly increase the masonry compressive strength. Eg. 8 to 10 fold increase in cube compressive strength of Mortar could result in 50 to 75% increase in compressive strength of Mortar Masonry. For a given flow value of 100% compressive strength of 1:6 Cement Mortar, 1:1:6 Cement lime Mortar and 1:2:6 Cement soil Mortar is in the same range of 5.5 MPa. Pure lime Mortar and LP Mortars lead to very low mortar compressive strength.

### Workability

Workability of the Mortar should be such that it allows the mason to spread the mortar easily and adhere well to the masonry unit. Water cement Ratio affects the Workability. Workability of fresh Mortar can be measured by the test dropping ball Test, Cone impression test, slump Test



Dropping ball test and cone impression Test generally do not give consistent results and penetration (of the ball and cone) is affected when the water cement Ratio is  $> 1.1$  in pure cement Mortar. Flow table test is adopted to measure / quantify the workability of Fresh Mortar expressed as flow value.

Flow is defined as the resulting increase in the base diameter of Mortar mass expressed as a percentage of original base diameter. The arrangement of flow table test is such that when rotation is given through a cam and shaft assembly, the table drops through a height of  $12.7 \text{ mm}$ . Higher values of flow can be achieved for cement soil Mortar and cement lime Mortar when compared with Pure Cement Mortar.

Q.11. A brick masonry prism is made of 6 Bricks jointed by Mortar of thickness  $2 \text{ cm}$ . The Brick is  $8 \text{ cm}$  in thickness. The Prism is subjected to uniform vertical stress of  $5 \text{ MPa}$ . The Brick has a modulus of  $800 \text{ MPa}$  and Mortar has a Modulus of  $9000 \text{ MPa}$ . Determine the horizontal lateral stress in the brick and Mortar. Assume Poisson's Ratio of Brick/Mortar =  $0.1$

Sol:  $t = 2 \text{ cm}$   $E_b = 800 \text{ MPa}$   
 No. of Bricks = 6 Nos.  $E_m = 9000 \text{ MPa}$   
 $\sigma = 5.0 \text{ MPa}$   $\mu_b = 0.1$   
 $\mu_m$

$$\frac{E_b}{E_m} = \frac{800}{9000} = 0.089 \quad E_b < E_m \text{ - case (b).}$$

$$\sigma_m = p \cdot E_b \cdot \frac{d}{t} \left( \frac{\mu_b}{E_b} - \frac{\mu_m}{E_m} \right)$$

$$\frac{d}{t} = \frac{8}{2} = 4$$

$$\left[ (1 - \mu_b) + \frac{E_b}{E_m} \cdot \frac{d}{t} (1 - \mu_m) \right]$$

$$\sigma_m = \frac{5 \times 4 \times (0.1 - 0.1 \times 0.089)}{(1 - 0.1) + (0.089 \times 4 \times (1 - 0.1))}$$

$$= 1.492 \text{ MPa (tensile).}$$

$$\sigma_m = \sigma_b \times \frac{d}{t}$$

$$\sigma_b = \sigma_m \times \frac{t}{d} = 1.492 \times 0.25 = 0.373 \text{ MPa.}$$

(compressive)

### Module-3

Q5. Name different types of Pozzolana Materials. Explain any two in detail.

Sol. Different types -  
 1. Powdered burnt clay (Surkhi)  
 2. Fly Ash  
 3. Rice husk Ash.

**Powdered burnt clay** - It is produced by artificial burning of clay in a kiln or by selecting waste of burnt clay material like bricks, tiles and pottery. When clay is burnt in kiln for the purpose of making Pozzolana, it is desirable to select a soil with a high proportion of clay. If the clay occurs along with large amount of sand, the sand may be removed by sieving to obtain high clay soil. This is necessary since

Sand is delucent and does not react with lime in the manner in which pozzolana. The high clay soil may now be made into thin briquettes. The wet clay may be spread on level ground to a thickness of 2.5 cm and then sliced into thin cakes of size 10 cm x 10 cm x 2.5 cm. These cakes now dried and then charge d into the kiln with alternate layers of fire wood. The fire wood used could be 10% of the weight of the clay. With this amount of fire wood at a temperature of 700°C can be expected. The burnt clay may now be pulverized to about 90µ size particles. Ball Mills are used for this purpose. This pozzolana can be stored in bags without any loss of its reactivity.

**FLYASH** - Flyash as pozzolana is used. It is obtained from thermal power stations which use pulverized coal as the fuel. The fine particles of burnt clay, which are collected in electro static precipitators are known as flyash. They contain significant amount of amorphous silica and alumina. Flyash is a waste product and may be considered as a zero thermal energy material, unlike burnt clay which needs specific energy inputs.

Q55. Write a Note on i) Metallic fibre ii) Natural fibre  
Sol:- Glass fibre Metallic fibre - are made up of carbon steel or stainless steel. The Tensile strength ranges from 345 MPa to 1380 MPa The Modulus of Elasticity is 200 GPa.

The fibre cross section may be circular, rectangular, crescent-shaped or irregular. Most common steel fibres are round in cross-section with a dia ranging from 0.4 to 0.8 mm & length ranging from 25 to 60 mm. The aspect ratio is less than 100. with a common range of 40 to 80.

Round and straight steel fibres are produced by cutting into small pieces thin wires. In order to improve the bond, the fibres have been indented, crimped, hooked at the end and enlarged at the ends. Fibres with crimped or hooked end are also available in collated form.

collation is done by gluing the fibres together along their sides with water soluble glue. dissolve during the mixing process facilitating the distribution of the individual fibres in the concrete matrix. Collation enables the use of larger volume fibre fraction and aspect ratio of fibres without balling. Fibres are also produced from wires that have been shaved down in the steel wool making process and such fibres have a crescent shaped cross section. Fibres are also produced by melt extraction process, In this process, a rotating wheel comes in contact with the molten metal and lifts off liquid metal which rapidly solidifies to form a fibre. These fibres have irregular surface with crescent shaped cross section.

Natural fibre - Some of the natural fibres used in Portland Cement Composite are akwara, bamboo

coconut (Coir), jute, sisal, sugarcane, bagasse wood and elephant grass. These fibres are sufficiently strong in tension, their Modulus of elasticity is quite low. Akwarafibre is extracted from a vegetable plant stem, which is grown in large quantities in Nigeria. They are found to be durable in the alkaline environmental and dimensionally stable under alternate wetting and drying conditions. Bamboo fibres have a tendency to absorb water, which adversely affects the bonding between fibre and the matrix during the curing stage. Fibres extracted from coconut are called as coir. Coir fibres are short in length are found to be sensitive to moisture changes. Sisal fibre is extracted from leaves of agave sisalana and it consists of hemicellulose, lignin and pectin. Sisal fibres even though relatively strong, are not durable in alkaline environment. Elephant grass fibre are extracted from elephant grass stems, which grows upto a height of 3m. These fibres are having high tensile strength and Young's Modulus and process of extracting fibre from wood is called pulping and the process can be mechanical, chemical and semichemical. Delignified fibres have been reported to have tensile strength as high as 2000 MPa, whereas the strength of fibres in which lignin has not been removed at all is 500 MPa. Lignin free fibres are expansive.

Q.6.a) List the agro wastes and mention its application in the building construction.

Sol. Agrowaste which can have applications in building construction. are

Rice husk Ash, Rice husk, Bagasse, sugar cane tops, Coir fibres, Sisal fibre, Straw, Coconut and Areca nut tree trunks, Coconut leaf.

Use of sugarcane tops are more durable, they are used for thatching, coconut & Areca nut trees trunks have been used as timber. Coconut leaf is also used for thatching. Rice husk phenol formaldehyde boards are used as replacement of plywood panels. Rice husk ash, when rice husk is burnt under controlled conditions result in amorphous silica with excellent pozzolanic properties. Coir and sisal fibre have been used for fibre cement composites. Coir & sisal fibre along with polyester resin as a matrix appears cheaper, energy efficient alternative to glass fibre reinforced polyester composites.

Bamboo, cane and lantana and other biomass resources with potential in building construction. Bamboo is used in housing in North east region of India. Use of Wattle and daub for wall is used in regions of Mysore and Shimoga. Cane is used for making furniture. Woven mats of lantana is used as reinforcement for wattle and daub walls or partition boards.

Q6.6 What are different industrial wastes used effectively in construction industry. Explain any 3 materials

Sol:- Industrial Waste are ~~as~~

1. Flyash from thermal power stations
2. Blast furnace slag from steel plants
3. Mine wastes from iron ore mines.
4. Tailings from copper mines
5. Fine rock dust from gold mines
6. Granite polishing waste
7. Marble Polishing waste
8. Rock dust from Stone crushers
9. Red mud from Aluminium factories
10. Brick, Mortar and Concrete waste from demolished buildings.

### Blast Furnace slag

The slag from blast furnace has cementitious properties, Portland blast furnace slag cement is made by grinding normal clinker with slag. This cement has sulphate resisting properties and is ideal of use in aggressive environment.

### Iron ore Tailings

The Kudremukh iron ore company of Karnataka has stored iron ore tailings to the tune of 150 millions tons. This waste has sand particles to the extent of 79% and silt particles

to the extent of 19%. This can be an ideal <sup>15</sup> sand substitute for local construction activity

## Gold Mine Tailings

Gold is often extracted from finely crushed granite. The waste granite dust after removal of gold is a fine material with no known use. It is often silty in nature and does not have pozzolanic properties. The Kolar gold fields of Karnataka have 35 million tons of such waste. It is used for building blocks after mixing with cement and sand.

## Module-4

Q7a. What are primary functions of a roof? Explain briefly the various roofing alternative

Sol. Primary function—

1. Withstand imposed dead and live load
2. Prevent leakage of water during rain
3. Provide a secure enclosure
4. Keep costs low
5. Provide durable roof covering.
6. Promote thermal comfort in the interior.

Various Roofing alternative—

1. Alternative to normal RC Roof slab is a beam and slab roofing which has a reduced slab thickness. It saves steel and concrete by using the material



more efficiently. The increased efficiency of the beam and slab system, the heat transfer through a thinner roof slab can increase the thermal transfer through a thinner roof slab can increase the thermal discomfort. Beam and slab concept is composite constructions using different material for the beam and the panel. Such system where beam & panel are structurally integrated known as composite T beam roof. In this case the beam may be built up steel and RC or Timber while the panel may be of concrete, brick work or stone.

2. Filler slab is another concept which has been in use in this, a part of concrete in the tension zone of a R.C Slab roof is replaced by a cheaper lighter alternative. 23% of the concrete could be replaced by mud blocks
3. Brick masonry vaulting is another concept of an integral roof. Such roof require very little steel and can provide good performance over a long period of time. It can be used as alternative building blocks like concrete blocks or stabilized mud blocks for masonry. Spherical domes using brick masonry are again equally feasible when the plan area to be covered is circular or square.
4. Hyperbolic paraboloid shell roof using thin reinforced concrete is another material which can be used an integral roof

Q7b. What are the Materials used in Ferrocement  
Explain the construction Method in brief.

Ans. The Materials - Cement, Sand, wire mesh and steel bars  
High tensile steel wires are also used for prestressed  
ferrocement; skeletal steel and Admixture can be  
used as ferrocement.

### Construction Method

Ferrocement construction does not require skilled  
labour nor heavy capital investment on  
equipment to produce them. There are four major  
Steps in ferrocement construction viz Placing  
of reinforcement, mixing of Mortar, placing  
Mortar and curing. As the reinforcement content  
in ferrocement is very high (upto 8% of Volume) it  
is uniformly distributed throughout the thickness  
of the element. The essential requirement is that  
the continuous mesh reinforcement has to be  
completely impregnated and covered with cement  
Mortar. During this process care must be taken to  
ensure full penetration of Mortar and elimination of  
voids within the thickness of the Panel. Hand  
vibrators may be adopted when available  
while casting using mould. Moulds of metal  
wood or masonry are made to suit the shape  
of the ferrocement component.

- i) One stage Technique -
- ii) Two stage Technique -
- iii) Sectional Plastering -

In one stage technique it consists of single application of Mortar from outside to inside of Mesh and subsequently finishing it off to a smooth surface before initial set takes place.

Two stage Techniques - In this process mortar is plastered from outside without fully penetrating through all the mesh layers and the outer surface is finished smooth and cured. later the remaining portion is plastered with Mortar. To assist in bond between the old and new Mortar, Cement ~~on~~ ~~the~~ grout is applied before second stage plastering is carried out on the old mortar. This technique is adopted when more than five layers of mesh is used.

Sectional plastering - while undertaking plastering of large ferro-cement structures, it may be preferable to plaster in sections using one stage techniques, necessitating the need for construction joints. The disadvantage of this method is the difficulty is obtaining a smooth construction joint due to differential shrinkage of mortar layers of different ages.

OR.

Qs. a Explain Composite masonry and cavity wall masonry  
Sol.

## Composite Masonry

Building built with two different materials are called composite masonry. The materials selected may be stone - cum brick, stone cum SMB, burnt brick - cum - unburnt brick and so on. This can lead to using a very durable material on the external face and material of moderate durability in the interior. This method is useful in cost reduction and reduction in wall thickness. Combining stone and brick in building a composite wall of 29cm thickness. It is also important that two layers of different materials need to be bonded by periodic use of through stones. The stronger material ignoring the strength of the weaker material.

## Cavity Wall Masonry

Such walls are common in Western countries to improve the thermal insulation of the walls. In countries like India, such concept may be used in very hot regions to prevent penetration of solar heat through walls. Overall wall thickness may have to be more than 40cm if these techniques are to be effective.

It is important to use bond bricks / blocks to bond the two layers. The bond blocks could be made of concrete with a strength of at least 5 MPa to obviate separation of the veneer through shearing of bond blocks. The cavity can also be filled with brick bats or coal cinder to

20.

improve the insulation are necessary only for external walls facing east and west and all the other walls of 23 cm thickness.

Q8b. Write the advantages and disadvantages of Mivan construction

Sol: Advantages -

- \* Mivan formwork requires relatively less labour
- \* Faster completion of floors
- \* Lesser number of joints and reduced leakages
- \* Smooth finishing of wall and slab
- \* Low maintenance
- \* More seismic resistance
- \* Huge carpet area
- \* Good quality construction work.

Disadvantages -

- \* Higher cost
- \* Finishing lines will be visible.
- \* No room for alterations or modifications
- \* Prone to visible cracks which can be avoided which can be avoided if precautions are used
- \* Requires uniform planning to reduce costs and alterations.

### Module 5

Q9.a What are the advantages and disadvantages of manufacturing concrete from RMC plants

Advantages -

1. Better quality concrete is produced as it is made from consistent methods and in advanced equipment
2. No need to store construction materials at the site
3. Labour associated with the production of concrete is eliminated. Thereby reducing labour cost
4. Air and noise pollution at the site is reduced
5. Wastage of basic materials at the site is avoided
6. Reduce the time required for construction
7. No delays in completing major projects like constructing dams, roads, bridges, tunnels etc
8. Economy in the use of raw materials results in conservation of natural resources
9. Safe work practices - No disruption in the project schedules
10. Environmentally friendly.

Disadvantages -

1. Require huge initial investment
2. Not suitable for small projects
3. Need effective transportation system from

the batching plant to the job site

4. Labour should be ready at the site to cast the concrete in position without any delay to avoid slumps in the mixture.

5. Concrete has limited time and should be used within 120 minutes of batching the plant. Traffic jam or break down of the vehicle can create a problem.

Q9.6 What is meant by precast elements? What are the advantages of precast elements.

Sol: Precast Construction Technology consists of various precast elements such as walls, beams, slabs, columns, staircase, landing and some elements that are standardized and designed for stability, durability and structural integrity of the building.

Advantages -

1. Manufacture of precast elements concurrent with commencement of early site work
2. Expedited construction
3. Reduce time on site
4. Reduce site defects
5. Reduce propping and scaffolding costs

- 6. Lower site labour cost
- 7. Reduce plant, amenities, tools and materials storage on site
- 8. Minimize finance cost resulting from reduced build times
- 9. Earlier revenue receipts because of shorter project times.
- 10. Concrete curing time will not affect project time. Most precast products are trafficable after installation.

OR.

- Q10a. Write a Note on.
- i) Type of concrete mixers
  - ii) Cost concepts in buildings.

Sol:- Types of Concrete Mixers -

- 1. Batch Mixers
  - \* Drum type mixer
    - Tilting drum mixer
    - Non tilting drum mixer
    - Reversing drum mixer
  - \* Pan mixer
- 2. Continuous Mixer.

Batch mixers are widely used machine for concrete mixing concrete mix obtained by this mixer is collected batch by batch and time by time so it is called as Batch Mixer



After pouring all the materials into Pan or drum, it mixes all of those for some time and finally discharges. This process is repeated until required amount of concrete mix is obtained.

Tilting Drum Mixers means the drum will discharge concrete by tilting downwards. It is rapid discharge process and used for larger projects.

Non Tilting drum Mixers are not allowed to tilt and the drum rotates about its horizontal axis. For the discharge of concrete of concrete a chute is arranged in inclined position which will receive the concrete mix from drum and discharges out.

Reversing drum mixers are similar to non-tilting type mixers but in this case reversal of rotation takes place for different action. The drum has two openings, one end is for pouring materials and other end is for discharge of mix.

### Cost Concepts in building.

Cost of all the construction portions of a project generally based upon the sum of the construction contract and other direct construction costs.

1. Direct Cost of Construction
2. Indirect Costs of construction

## Indirect Cost of Construction project -

The costs, unlike direct costs, is not directly accountable for a particular facility, product or function. Indirect costs can be either variable or fixed.

## Direct cost of Construction Project -

The cost and expenses that are accountable directly on a facility, function or product are called as direct cost. In construction projects the direct costs are the cost incurred on labour, material, equipment etc

The concept of cost is used for owning, running or using something.

Q106. What are the equipments used for producing stabilized mud blocks. Explain them in brief.

Sol. Equipments used are -

Auram 3000, Earth Block Press in 1990

Auram 4000 Press

Auram Press 4000 A

Auramix 5000

Auram Press 4000 - A semi automatic earth block press with a Practical output of 300-350 full blocks or 600-700 half blocks per hour.

The design is based on the successful design of the auram Press 3000. A Maximum of 20 metric tons peak force on the Block surface is achieved

with a minimum amount electrical or diesel power

During operation of the lid of the mold is closed automatically pre-compressing the earth within the mold. Then with a single command the primary hydraulic cylinder compresses the block from the bottom. opens the lid and ejects the block.

The Maximum output of 1000 blocks per hour is produced. It is based on the successful design of the Auram 3000 manually operated CEB press of which more than 1000 have been sold world wide. The Block height could be 90 or 100mm

*Hijayavar*  
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