3RD SEMESTER, CIVIL ENGINEERING
BUILDING CONSTRUCTION(TH-1)

Unit-1: Overview of Building Components

2 MARKS QUESTIONS & SOLUTIONS

1. **Classify the buildings as per National building code.**

Ans: According to the National Building Code (NBC) of India, a building is classified into nine categories:-

a) Group-A. Residential Buildings
b) Group-B. Educational Buildings
c) Group-C. Institutional Buildings
d) Group-D. Assembly Buildings
e) Group-E. Business Buildings
f) Group-F. Mercantile Buildings
g) Group-G. Industrial Buildings
h) Group-H. Storage Buildings
i) Group-I. Hazardous Buildings

2. **.What is Educational buildings as per NBC ? Give examples**

Ans: The buildings which are used for providing education or training are known as educational buildings.

Ex- Schools, colleges, and universities etc.

3. **What is Institutional buildings as per NBC ? Give examples**

Ans: The buildings which are used for care, treatment, imprisonment, etc. are known as institutional buildings.

Ex- Hospitals, nursing homes, orphanage, old age homes, prisons, jails etc.

4. Differentiate between Institutional buildings and Business buildings as per NBC.

Institutional buildings	Business buildings
The buildings which are used for care, treatment, imprisonment, etc. are known as institutional buildings	The buildings which are used for business transactions, and for maintaining the records and accounts are known as business buildings
Ex- Hospitals, nursing homes, orphanage, old age homes, prisons, jails etc	Ex-Offices, Banks, library, labs, radio centers, telephone exchange etc.

5. Write is Hazardous buildings as per NBC ?

Ans: The buildings which are used to store and process extremely inflammable material or goods are termed as hazardous buildings. These hazardous materials can produce excessive toxic fumes or explosions during a fire. Group I buildings may store the explosives or chemicals which are to be kept with great care at specific pressure or temperature. Acetylene, rocket fuel, liquefied petroleum gas (LPG), compressed natural gas (CNG), etc. are accommodated in hazardous buildings.

6. What are the advantages of framed structure building?

Ans:- The framed structures offer the following advantages:

a. The framed structure offers good stability and strength. These structures can easily withstand earthquake loads and wind loads.
b. These structures can be used to construct multi-story buildings.
c. These structures can absorb the shocks and vibrations in a better way as compared to load bearing structures.

7. What do you mean by sub structure of building ?

Ans:- Substructures or foundations can be defined as all lower structures of building below ground level which helps in transmitting loads of superstructures to the soil. A foundation is that part of the building structure which is in direct contact with the supporting soil and transfers structural loads.

8. Why plinth is important to the buildings?

Ans:- The important advantages of the plinth in building construction are as follows:

- The plinth distributes loads of the superstructure evenly to the foundation.
- It acts as a barrier to the dampness and moisture reaching the superstructure.
- The plinth protects from water seepage in a framed structure.
- It protects the building from cracks at the time of settlement of the foundation. It provides durability and stability to the superstructure.
- It gives a better aesthetic appeal to the structure.

9. Define the term:-Sill, Lintel

Ans: Sill- Sill a horizontal surface made up of mortar located below the window and having a width equal to the width of the wall below the window. It provides a smooth finished surface and support to the window.

Lintel:- Lintels are horizontal stripes such as beams or any structural member, which are used to cover the opening and support the structure above the opening of the doors and windows.

10. Why is a mezzanine floor provided in a building?

Ans:- The mezzanine floor may be defined as an intermediate floor that lies between the floor and the ceiling. Mezzanine floors are temporary or semi-permanent structures that are used to maximize the use of the space in the building.

5 MARKS QUESTIONS

1. Describe the functions of building components in detail

Ans:- Building components perform specific functions ensuring structural integrity and functionality:

Foundation: Transfers all loads from superstructure to soil, distributes loads over larger area, provides stability, prevents settlement, and keeps loads within safe bearing capacity of soil.

Plinth: Elevates building above ground level protecting from moisture and flooding, acts as retaining wall for earth filling, prevents dampness through capillary action, distributes loads to foundation, and provides level platform for construction.

Walls: Provide enclosure and privacy, support loads from roof and floors in load bearing structures, protect from weather elements, provide thermal and acoustic insulation, divide interior space, and serve as base for fixing doors and windows.

Columns: Transfer vertical loads from beams to foundation, provide vertical support in framed structures, resist lateral forces, enable large open spaces, and allow flexibility in floor plan design.

Beams: Transfer loads from slabs to columns or walls, span horizontally between supports, resist bending and shear forces, provide support for floors and roofs, and enable construction of larger spans.

Floors: Provide flat surface for activities, separate different levels, transfer loads to supporting members, provide fire resistance between stories, act as horizontal diaphragms, and provide sound insulation.

Roof: Protects from weather conditions, provides thermal insulation, completes building envelope, prevents water infiltration, and provides aesthetic finish.

Doors and Windows: Provide access and egress, allow natural light and ventilation, provide views and security, enable emergency escape, and control privacy.

Lintel: Supports wall load above openings, transfers loads to sides of opening, prevents cracks above doors and windows, and maintains structural integrity.

Sill: Provides horizontal member at bottom of windows, throws off rainwater, prevents water penetration, and provides base for window frame installation.

2. Discuss the types of construction: Load Bearing, Framed, and Composite structures

Ans:- Load Bearing Structure:

Load bearing construction uses walls as primary load-carrying members that transfer all loads directly to foundation.

Characteristics:

- Walls carry roof, floor, and self-weight loads
- Wall thickness increases with height (230-450 mm)
- No skeletal frame of beams and columns
- Limited to low-rise buildings (up to 6 stories)

Load Path: Roof/Slab → Walls → Foundation → Soil

Advantages: Lower initial cost, simple construction, better thermal mass, economical for low-rise buildings, uses locally available materials.

Disadvantages: Limited height, thick walls reduce floor area, inflexible floor plan, longer construction time, poor earthquake resistance.

Applications: Residential houses (1-3 stories), small commercial buildings, rural construction.

Framed Structure:

Framed structure consists of skeletal framework of beams and columns carrying all loads, with walls serving as partitions only.

Characteristics:

- Beams and columns form structural frame
- Walls are non-load bearing (curtain walls)
- Suitable for multi-story and high-rise buildings

- Constant wall thickness regardless of height

Load Path: Roof/Slab → Beams → Columns → Foundation → Soil

Advantages: Unlimited height capability, faster construction, flexible floor plans, better earthquake resistance, thinner walls provide more usable area, large spans possible.

Disadvantages: Higher initial cost, requires skilled labor, complex design, longer curing period, economical only for multi-story buildings.

Applications: High-rise buildings, office complexes, hospitals, shopping malls, industrial structures.

Composite Structure:

Composite structure combines features of both load bearing and framed systems, with external load bearing walls and internal RCC columns.

Characteristics:

- External walls are thick and load bearing
- Internal supports are RCC columns
- Combines advantages of both systems
- Suitable for large span roofs

Load Path: Roof loads partly to walls and partly to columns; external floor loads to walls; internal floor loads through beams to columns.

Advantages: Economical for large spans, better weather protection from thick external walls, open interior spaces, better thermal and acoustic insulation.

Disadvantages: More complex design, different construction techniques must be integrated, complex load distribution.

Applications: Industrial buildings, warehouses, assembly halls, exhibition centers, sports facilities.

3. Describe the components of substructure with their functions

Ans:- Substructure comprises all structural elements below ground or plinth level, forming the interface between superstructure and soil.

Foundation:

Foundation is the lowest structural part having direct soil contact.

Functions:

- Distributes concentrated loads over larger soil area reducing stress
- Transfers all loads (dead, live, wind, seismic) safely to soil
- Provides stable base preventing settlement or sinking
- Ensures soil remains within safe bearing capacity
- Anchors building against uplift forces
- Provides level platform for superstructure construction

Types: Shallow foundations (strip footing, isolated footing, combined footing, raft foundation) and deep foundations (pile, well, caisson).

Footing:

Footing is the enlarged base portion of foundation directly contacting soil.

Functions:

- Spreads concentrated column or wall loads over larger area
- Reduces contact pressure on soil to safe limits
- Minimizes differential settlement
- Creates stable base for columns and walls

Types: Stepped footing (with stepped increases), sloped footing (with sloping sides), flat footing (uniform thickness).

Plinth:

Plinth is the portion between ground level and floor level, typically elevated 45-60 cm.

Functions:

- Distributes wall and column loads evenly to foundation
- Raises building protecting from water accumulation
- Prevents dampness and moisture through capillary action
- Protects from surface water and minor flooding
- Acts as retaining wall for earth filling
- Prevents termite and insect infestation
- Reduces crack propagation from foundation
- Provides aesthetic base and level platform

Plinth Beam:

RCC beam at plinth level connecting columns and walls.

Functions:

- Distributes column loads uniformly to foundation
- Connects all columns preventing independent movement
- Resists lateral forces and prevents column buckling
- Reduces differential settlement effects
- Prevents crack development in walls

- Improves earthquake resistance by tying structure

Damp Proof Course (DPC):

Horizontal water-repellent layer at plinth level.

Functions:

- Blocks capillary rise of groundwater into walls
- Protects walls from dampness and deterioration
- Prevents moisture damage to interior finishes
- Prevents mold and mildew growth

Materials: Bitumen, polyethylene sheets, cement concrete with waterproofing, mastic asphalt.

4. Explain the difference between load bearing and framed structures with suitable examples

Ans:- Fundamental Difference:

Load bearing structures use walls as primary load carriers, while framed structures use beams and columns with walls merely as partitions.

Key Differences:

Structural System:

- Load Bearing: Thick masonry walls (230-450 mm) carry all loads. Example: Traditional brick house with 350 mm walls carrying roof load.
- Framed: RCC/steel beams and columns form skeleton; thin walls (100-150 mm) only divide space. Example: Modern apartment building with visible column spacing and glass walls.

Load Transfer:

- Load Bearing: Roof → Walls → Foundation → Soil. Upper floor walls must align exactly with lower walls. Example: Two-story village house with aligned wall layout.
- Framed: Roof → Beams → Columns → Foundation → Soil. Discrete load paths. Example: Office building where floors hang from beams spanning between columns.

Height Limitations:

- Load Bearing: Economical up to 2-3 stories, maximum 6 stories. Example: Most rural residential houses (1-2 stories).
- Framed: No height limitation. Example: Burj Khalifa, Empire State Building, all urban high-rises.
- Flexibility: reconfigured partitions.

Construction Speed:

- Load Bearing: Slow, labor-intensive, sequential floor-by-floor. Example: 1500 sq ft house taking 6-8 months.
- Framed: Faster with prefabrication, simultaneous activities. Example: Similar apartment completed in 3-4 months.

Cost:

- Load Bearing: Lower for low-rise (₹1200-1500/sq ft). Example: Two-story residential building.
- Framed: Higher initially but economical for high-rise (₹1800-2200/sq ft). Example: Multi-story commercial building.

Earthquake Resistance:

- Load Bearing: Poor to moderate, brittle failure. Example: Traditional buildings collapsed in Nepal earthquake (2015).

- Framed: Excellent resistance, ductile failure. Example: Properly designed RCC buildings performed well in Japan earthquakes.

Span Capability:

- Load Bearing: Limited span (3-4 meters), frequent walls needed. Example: Traditional house with 3m × 3.5m rooms.
- Framed: Large spans (6-12 meters standard). Example: Auditorium with 25m span, airport terminals with 40m+ spans.

Practical Examples:

Load Bearing: Village school - single story, individual classrooms separated by walls, limited window area, simple construction.

Framed: Modern university - multiple floors, large lecture halls, abundant natural light through large windows, flexible space utilization.

- Load Bearing: Fixed layout; walls cannot be removed. Example: Old house where removing wall causes structural failure.
- Framed: Highly flexible; walls can be added/removed. Example: Corporate office with regularly

5. Describe the importance of plinth in building construction.

Ans:- Definition:
Plinth is the raised platform or portion of a building between the ground level and the floor level (plinth level), typically elevated 45-60 cm (1.5-2 feet) above the surrounding ground. It forms a critical component of the substructure.

Importance and Functions:

1. Protection from Water and Moisture:

Surface Water Protection:

- Raises building above ground level preventing water accumulation around walls
- Protects from rainwater runoff and puddles Moisture Barrier:
- Prevents ground moisture from rising into walls through capillary action
- Blocks dampness that can damage walls, plaster, and paint
- Protects interior finishes and furnishings from moisture damage
- Maintains structural integrity of wall materials

Damp Proof Course Integration:

- Provides elevated location for DPC installation
- Creates effective moisture barrier when DPC placed at plinth top
- Enhances effectiveness of waterproofing systems

2. Structural Functions:

Load Distribution:

- Distributes concentrated loads from columns and walls uniformly to foundation
- Spreads loads over larger foundation area
- Reduces stress concentration on foundation
- Acts as transition element between foundation and superstructure

Foundation Protection:

- Covers and protects foundation from weather exposure
- Prevents foundation erosion from surface water
- Shields foundation from soil movements and freeze-thaw cycles

Crack Prevention:

- Minimizes crack propagation from foundation settlement to superstructure
- Absorbs minor differential settlements
- Provides buffer zone between substructure and superstructure

3. Earth Retention:

Retaining Function:

- Acts as retaining wall for plinth filling material
- Holds earth or sand filling between foundation and floor level
- Prevents soil spillage around building perimeter
- Provides stable platform for floor construction

Platform Creation:

- Creates uniform, level surface for floor laying
- Ensures proper floor levels throughout building
- Facilitates accurate floor construction

4. Pest and Termite Prevention:

Elevated Position:

- Raises structure away from ground-dwelling pests
- Creates physical barrier against termite entry
- Reduces insect infestation from soil
- Makes pest inspection and treatment easier

Chemical Treatment Zone:

- Provides location for anti-termite treatment application
- Enables effective pest control measures
- Protects wooden components and furniture

5. Aesthetic Enhancement:

Architectural Definition:

- Provides defined base to building structure
- Creates visual foundation for superstructure
- Adds proportion and scale to building appearance
- Enhances overall architectural appeal

Design Element:

- Can be designed with decorative features
- Creates horizontal line defining building base
- Contributes to building's visual character

6. Ventilation and Air Circulation:

Underfloor Space:

- Creates air space beneath floor
- Allows air circulation reducing dampness
- Prevents musty odors in ground floor rooms
- Improves overall indoor air quality

7. Durability Enhancement:

Longevity:

- Significantly increases building lifespan
- Reduces maintenance requirements
- Protects structural elements from premature deterioration
- Maintains strength of load-bearing materials

Weather Resistance:

- Protects building from harsh weather conditions
- Reduces weathering of wall materials
- Maintains appearance over time

8. Health and Hygiene:

Moisture Control:

- Prevents mold and mildew growth
- Reduces respiratory health problems
- Maintains healthy indoor environment
- Prevents deterioration of belongings

9. Economic Benefits:

Long-term Savings:

- Reduces repair and maintenance costs
- Prevents expensive moisture damage repairs
- Extends building life reducing replacement needs
- Lower healthcare costs from healthier environment
-

10 MARKS QUESTIONS

1. **Classify buildings as per National Building Code from Group A to I with detailed explanations and examples.**

Ans:- The buildings as per NBC criteria are classified into the following categories:

A. Residential Buildings
B. Educational Buildings
C. Institutional Buildings
D. Assembly Buildings
E. Business Buildings
F. Mercantile Buildings
G. Industrial Buildings
H. Storage Buildings
I. Hazardous Buildings

Group A: Residential Buildings

The buildings which have sleeping arrangements with or without cooking and dining facilities are known as residential buildings. According to NBC, Residential buildings are further divided into five sub-categories as follows:

A-1: Lodging and rooming houses: This type of building consists of a sleeping arrangement for fewer than 40 persons and doesn't have any cooking facility. The building or group of buildings with 40 beds or fewer lies in this category.

A-2: One or two-family private dwelling: The buildings which provide accommodation to one or two families with a bed capacity of 20 or less are known as A-2 type of residential buildings.

A-3: Dormitories: In dormitories, a group of sleeping accommodations is provided for public use. The users in the case of A-3 type residential buildings don't belong to the same family.

A-4: Apartment houses: Apartment houses are also known as flats. The buildings which have three or more quarters for living independently are known as apartments or flats. The cooking and dining facilities are provided in such types of buildings.

A-5: Hotels: The buildings which provide sleeping accommodations with or without dining facilities are classified as hotels.

Group B: Educational Buildings

The buildings which are used for providing education or training are known as educational buildings. Schools, colleges, and universities come under the category of education buildings. Group B buildings are further divided into two categories.

B-1: The schools up to the senior secondary class system come under the B-1 category of educational institutions

B-2: The teaching and training institutions that do not belong to the B-1 category are categorized under the B-2 category.

Group C: Institutional Buildings

The buildings which are used for care, treatment, imprisonment, etc. are known as institutional buildings. The institutional buildings consist of sleeping arrangements. Group C buildings are further divided into the following three sub-categories:

C-1: Hospital and Sanatoria: The buildings which are used for accommodating people who are suffering physically. Hospitals, nursing homes, healthcare centers, etc. come in this category.

C-2: Custodial Institutions: The buildings which are used for the protective care of children, old age people, teenagers, etc. are known as custodial institutions. The orphanage, old age homes, juvenile homes, etc. lie under the C-2 category of institutional buildings.

C-3: Penal and Mental Institutions: The buildings which are used for accommodating persons for restriction of their liberty are called penal and mental institutions. C-3 type institutional buildings include mental asylums, prisons, jails, etc.

Group D: Assembly Buildings

The buildings which are used for accommodating the gathering of 50 or more people are known as assembly buildings. The people can gather for social, religious, recreational purposes, etc.

According to NBC, the assembly buildings are further classified into the following seven categories:

D-1: The building which has a stage and fixed seats with an accommodating capacity of more than 1000 viewers are classified under the D-1 category of assembly buildings. Theatres, exhibition rooms, cinema halls, auditoriums, etc. are the D-1 category of assembly buildings.

D-2: The building which has a stage and fixed seats with an accommodating capacity of fewer than 1000 viewers are classified as a D-2 category assembly building.

D-3: The buildings which neither have a permanent stage nor fixed seats but have an accommodating capacity of 300 persons or more are known as D-3 assembly buildings.

D-4: The buildings which have the same characteristics as D-3 buildings but an accommodating capacity is less than 300, are known as D-4 assembly buildings.

D-5: All the other structures for the gathering of people which are not covered in the D-1 to D-4 subcategories lie in D-5 assembly buildings.

D-6: The buildings which have mixed facilities of shopping, theatre, gaming, etc. lie under the D-6 category of assembly buildings. Modern-day shopping malls and multiplexes are examples of D-6 assembly buildings.

D-7: Any underground or elevated structure for the gathering of people for different purposes which is not covered by D-1 to D-6 categories is kept under the D-7 assembly building category.

Group E: Business Buildings

The buildings which are used for business transactions, and for maintaining the records and accounts are known as business buildings. Libraries, banks, offices, laboratories, etc. lie in this category of buildings. Group E buildings are further divided into three categories:

E-1: The buildings which are used as offices, banks, and other establishments are categorized as E-1 type of business buildings.

E-2: The buildings which are used as laboratories, research laboratories, testing houses, etc. are categorized as E-2 business buildings.

E-3: The buildings where groups of computers are installed are known as E-3 business buildings.

E-4: Telephone exchanges are categorized in this category.

E-5: Television stations and radio broadcasting stations lie in this category.

Group F: Mercantile Buildings

The buildings which are used as shops, retail stores, markets, wholesale shops, etc. are known as mercantile buildings. Mercantile buildings are further divided into the following three categories:

F-1: The shops or stores having an area equal to or less than 500 m2 are known as F-1 mercantile buildings.

F-2: The shops or stores with an area of more than 500 m2 are known as F-2 mercantile buildings.

F-3: The underground structures which are used as shops or stores are categorized as F-3 mercantile buildings.

Group G: Industrial Buildings

The buildings in which manufacturing, fabricating, assembling, and processing of materials and products are performed are known as industrial buildings. The buildings used by various industries like dairies, tanneries, dry cleaning plants, pump stations, etc. the examples of group G buildings. Industrial buildings are further classified into the following three categories:

G-1: The buildings which are used for low hazard industry come in this category. The materials and products accommodated in the G-1 type of building comparatively have low combustibility and there are very less chances of self-propagating fires.

G-2: The buildings which are used for moderate hazard industry come in this category. The material and products accommodated in such type of building burn at a medium speed but toxic fumes or explosions during a fire are not generated.

G-3: The buildings which are used for high hazard industry come in this category. The materials and products accommodated in such type of building burn rapidly. Toxic fumes and explosions during the fire can be generated.

Group H: Storage Buildings

The building or part of the building that is used to store the goods, products, merchandise, etc. except the hazardous material is known as a storage building. Storehouses, grain storage, fruit stores, garages, cold storage, animal shelters, etc. are examples of group H buildings.

Group I: Hazardous Buildings

The buildings which are used to store and process extremely inflammable material or goods are termed as hazardous buildings. These hazardous materials can produce excessive toxic fumes or explosions during a fire. Group I buildings may store the explosives or chemicals which are to be kept with great care at specific pressure or temperature. Acetylene, rocket fuel, liquefied petroleum gas (LPG), compressed natural gas (CNG), etc. are accommodated in hazardous buildings.

2. Explain the importance of Wall in building construction. Write down different types of wall in detail.

Ans:- Walls are the most important parts of the building's superstructure. A wall can be used for the transfer of load or for just partition purposes. The walls which are used to transfer the loads are known as load-bearing walls while the walls which don't act as a load-bearing structure are known as non load- bearing walls. Some of the salient features of a wall in building construction are given as follows:

- It should be strong to carry its own weight.
- It must be capable of carrying and transmitting the load of the roof to the substructure.
- It must be strong enough to support the opening of doors and windows.

- It helps in the space management of buildings to make them more useful.
- It protects the occupants from heat, rain, and cold and provides privacy.
- It acts as a sound barrier.
- It should be fire-resistant.

Walls are of different types depending on their usage and location such as cavity walls, partition walls, retaining walls, compartment walls, dwarf walls, parapet walls, and curtain walls.

Cavity wall

Cavity walls are types of walls made up of two different walls joined with the help of wall ties. In this type of wall, an outer wall is attached with the help of ties to the inner wall separated by cavity/airspace. Metal strips are used as wall ties. Generally, wall ties are placed at the gap of 90 cm along the length and 45 cm in the direction of height. The thickness of the external wall is kept at 10 cm and the thickness of the inner wall is as per the imposed load. The cavity wall protects the building from external wall moisture and rainwater and also provides space for the installation of thermal insulation. Buildings with cavity walls face a lesser impact of external temperature. This type of building remains cooler in summer and warm in winter. As the inner wall is protected from the external atmosphere, the life of the building also increases.

Partition wall

These types of walls are generally non load-bearing walls that are used to separate the internal common space of the building. This type of wall only carries its own weight. So, no foundation is required as in the case of a normal wall. It can be raised directly from the floor level. If the partition wall is not constructed up to the height of the roof and has a height of around 5 feet to 6 feet, then it is called a curtain wall. The partition walls can be easily seen in banks, railway stations, offices, hospitals, hotels etc. Materials used for the construction of partition walls are brick, timber, plywood, glass, aluminum sheets, PVC board, etc.

Parapet Wall

A parapet wall may be defined as a wall that is constructed along the perimeter of the roof. These are short in height. The parapet walls are used to provide safety to roof users. The parapet wall helps in the prevention of accidents. It is aesthetically pleasing and provides the users with

privacy. A parapet wall can be constructed of masonry, steel, stones, etc. The parapet walls can be provided in the form of railing too.

Retaining Wall

Retaining walls are structures designed to hold back soil or rock from a building, road, or other structure, preventing erosion and maintaining different ground elevations.

Characteristics:

- Resist lateral earth pressure
- Provide vertical face for elevation changes
- Prevent soil erosion and landslides
- Can be gravity or cantilever type
- Require proper drainage provisions
- Foundation must resist sliding and overturning

Faced Walls and Veneered Walls

These walls have facing and backing of different materials with varying degrees of structural integration.

Faced Walls:

- Facing and backing bonded together structurally
- Both materials act together under load
- Header stones or bricks provide bonding
- Composite structural action

Veneered Walls:

- Facing attached to backing but not bonded structurally

- No common action under load
- Facing is decorative, non-structural
- Mechanical anchors or adhesives attach veneer
- Backing provides all structural support

Boundary Walls (Compound Walls)

Boundary walls or compound walls are perimeter walls built along property boundaries to enclose and protect plots.

Characteristics:

- Typically 1.2 to 2.4 meters height
- Constructed of brick, stone, concrete blocks, or precast panels
- Pillars at regular intervals (2-3 meters) for stability
- Foundation depth 0.3-0.6 meters
- Coping at top for weather protection

UNIT-2: Construction of Substructure

2 MARKS QUESTIONS

1. **What is site clearance?**

   Ans:- Site clearance is the process taken to prepare a building site for its construction. It involves the clearance of vegetation, dead root mats, living or dead trees, and subsoil for a minimum depth of 30 cm from the ground surface.

2. **What is timbering in excavation?**

   Ans:- Timbering is defined as temporary support to the trench when there is loose sub-soil or the depth of the trench is deep. It consists of timber plank and strut.

3. **List any four functions of foundation.**

   Ans:-

a) Provides a stable base for the structure.
b) Distributes the building's load to the ground.
c) Prevents settling and movement.
d) Protects the structure from moisture and soil erosion.

4. . **What is a raft foundation?**

   Ans:- A raft foundation is a thick concrete slab reinforced with steel, designed to support columns or walls and transfer loads from the structure to the soil. It is used in cases where the soil has low bearing capacity or when multiple columns are close together, as it helps spread the building's weight over a large area, distributing the load evenly.

5. **Differentiate between isolated and combined footing.**

   Ans:-

- **Isolated footing** is used for a single column and is designed to support the load of that column.
- **Combined footing** is used for two or more columns and is designed to support the combined load of the columns.

6. **What is a well foundation?**

   Ans:-A well foundation is a type of deep foundation that is typically used in water bodies or soft soils. It consists of a cylindrical structure that is sunk into the ground and filled with concrete to provide support.

7. **What is dewatering?**

   Ans:-Dewatering is the process of removing water from a construction site to make it suitable for excavation and construction work. It is often done using pumps or other water removal techniques.

8. **Define caisson foundation.**

   A caisson foundation is a deep foundation that is constructed by driving or sinking a watertight chamber into the ground, which is then filled with concrete to provide support.

9. **What is plinth filling?**

   Plinth filling refers to the process of filling the area around the base of a building (the plinth) with concrete or other materials to provide a stable and level base for the structure.

10. **List tools used for earthwork.**

- Shovel
- Pickaxe
- Rake
- Level
- Excavator
- Bulldozer
- Compactor

11. Define shallow foundation.

A shallow foundation is a type of foundation that is placed near the surface of the ground, typically within a few feet of the soil surface, and is used to support the weight of the building.

12. What is a grillage foundation?

A grillage foundation is a type of shallow foundation that consists of a grid of beams or girders, which provides support for heavy loads and is often used for bridges or other structures.

13. What is a cofferdam?

A cofferdam is a temporary structure used to enclose a construction site, allowing water to be pumped out to create a dry working environment, especially in water bodies or soft soils.

5 MARK QUESTIONS

1. Explain the site clearance and layout procedure for load bearing structures.

Ans:- Site clearance is the process taken to prepare a building site for its construction. It involves the clearance of vegetation, dead root mats, living or dead trees, and subsoil for a minimum depth of 30 cm from the ground surface. Site clearance also involves the work related to the demolition of any prior structure before the actual construction takes place. All depression occurs due to the removal of topsoil, vegetation should be filled with suitable material. It also involves the work related to leveling and making the ground ready for construction work to start. Site clearance work is carried out very carefully and safely and all approval had to take before dumping the material taken out from the site. If any type of contaminated material such as asbestos or any hazardous materials is present on site, then an expert for the disposal of this type of material should be consulted before the disposal of hazardous material

The following recommendations are considered during the process of the site clearance:

(1) The area to be cleared is marked properly.

(2) The trees and vegetation on the site are to be cleared off. The details of the trees to be cut should be listed and the trees and vegetation are removed manually or mechanically.

(3) The topsoil is excavated using the excavating equipment. The excavators are used for the removal of the soil.

(4) All the depressions and pits created during the process of clearing the trees and during the removal of the vegetation must be filled and compacted properly. The excavated soil is used for this purpose.

(5) The water can be used during the compaction of the pits. The density of the compacted pits should be near the surrounding area.

(6) If the structures exist in the area, these should be demolished mechanically. The demolition waste is dumped at the approved dumping sites, and the useful waste is stored properly. The soil that is excavated must be stored properly. These materials can be removed using tractors and dumpers.

(7) The ground can be leveled using the dozers if required.

2. Explain the process of excavation for foundation with necessary precautions.

Ans:- Excavation can be defined as a process that helps in transferring subsoil, rock, or any other material using machinery and tools. It includes trenching, tunneling, earthworks, and wall shafts. One of the common practices using excavation is building construction. Excavation is primarily used in foundation for digging, trenching, and site development.

Excavation for small buildings is done manually using pick axes, spades, crowbars, etc. For deep foundations and for large buildings, excavation is carried out by using machinery for earth cutting. Setting out is done first to carry out excavation at the site. The Excavation is done on hard soil where the depth of the foundation is less than 1.5 m, trench sides don't require external support. In case of loose soil or deeper excavation, some type of support is required from preventing the sides to fall. Strutting and timbering are done continuously depending on the type of soil and foundation depth. In general, excavation trench width is kept equal to the width of foundation concrete, because wider excavation is not good for the strength and economy of the building as wider excavation

is to be filled later by losing soil. The foundations should be checked for depth and width while excavating.

The following points are considered while doing excavation work:

- If the soil does not permit the vertical sides of the trench, support should be provided. The shoring can be done for the unstable sides of the trench.
- The excavated material should be placed at least 1 m away from the place of the excavation.
- The bottom of the trench should be perfectly leveled.
- The bed of the foundation should be rammed before pouring concrete for better stability.
- The soft soils or the rocks should be removed and the bed of the trench should be leveled and filled with stabilized soil.
- The wires should be placed around excavation work so that no person or any stray animal from the outside area falls inside the excavated region.
- Underground water pipelines, gas pipelines, communication cables, etc. should be protected while digging a trench.
- During excavation, if any archeological item is found, it is considered government's property and should be deposited at the government office.
- Special care is required while digging adjacent to old buildings so no damage is done to adjacent property
- Permission from the forest department is required to cut or transfer live trees from the excavation site, whose circumference is more than 30 cm and height is more than 1 m from the ground.
- The surplus soil left after filling the trench site should be disposed of properly

3. Describe timbering and strutting in excavation work.

Ans:- Timbering and strutting are defined as temporary support to the trench when there is loose sub-soil or the depth of the trench is deep. It consists of timber plank and strut. According to Central Public Work Department (CPWD) manual, timbering is required for soft/loose soil if the depth of the trench is more than 2 m. In the case of hard and

stable soil, the depth of the trench should be greater than 2.5 m. Timbering is also known as shoring. After the completion of foundation work, timbering is removed from the trench.

Some important terms used in timbering and strutting are as follows:

(1) **Polling Board**: Polling boards are generally wooden boards having a width of about 200 mm and thickness of about 45-50 mm. They are placed horizontal, vertical, or continuous along the length of the trench. The height of the board is kept equal to the depth of the trench. The polling board has direct contact with the soil and prevents it from falling into the trench. They are also known as sheeting.

(2) **Ranger or wale:** Rangers are placed behind the polling board in a horizontal position to support and keep the board in a straight standing position. Wales are the planks having a width of 200mm to 250 mm and a thickness of around 400 mm.

(3) **Strut:** Strut is timber plank that joins wale of either side to each other and kept wale intact in their position. Strut is sometimes directly attached to the polling board. Strut is placed horizontally across the trench. The dimension of the strut is 100 × 100 mm up to 2 m width trench and 200 × 200 mm for trench having 4 m width.

(4) **Bracing:** Bracing is provided diagonally to strengthen the timbering on either side of the trench.

The deep trenches require timbering and strutting generally. The process followed for timbering and strutting of the deep foundation is explained as follows:

(1) **Stay bracing:** This method is used when the soil is firm or hard to support the trench side. In this case, the depth of the foundation is not exceeding more than 2 m. In this method, the

wooden planks are placed in the vertical position on both sides of the trench and connected

with the help of two or more rows of the strut. An interval of 2 to 4 m is kept between the polling boards, extending to the depth of the trench.

(2) **Box Sheeting:** When there is loose soil present at the site of the trench, the box sheeting method is adopted. Box sheeting can only be used for depth of excavation up to 4 m. In this method, the vertical or longitudinal wooden planks are placed next to each other, and wales are provided in vertical or longitudinal rows to keep them in position. These wales are connected across with the help of struts. If the height of depth is more than 4 m bracings are provided along with struts.

3. **Runner System:** This system is used when there is very loose and soft soil and required urgent

support to the side of the trench as excavation progressed. This system is similar to box sheeting, except in this system long wooden planks are used in place of vertical sheets.

(4) **Vertical sheeting:** Vertical sheeting is done for trench having deep excavation up to 10 m in soft soil. In this method excavation is carried out in stages and timbering is done similar to the box sheeting. The width of the trench of the foundation decrease as the depth increases and offsets are provided at each stage. Each stage is kept about 3 m the height and offset may vary from 250 to 500 mm per stage. Separate vertical sheeting is done for each stage supported by horizontal and vertical wale and struts.

4. **Discuss pile foundation and its types.**

Ans:- A pile foundation is a type of deep foundation that uses slender, long, column-like members called piles to transfer the load of a structure to stronger soil or rock layers below. This is necessary when the shallow soil is weak, compressible, or the structure is too heavy for a shallow foundation. Piles are typically made of materials like reinforced concrete, steel, or timber.

Types of pile foundations

Pile foundations are classified in various ways, including by their function, the material they are made of, and their installation method.

Based on function and load transfer

- **End-bearing piles:** These piles transmit the majority of the load from a structure through the pile's tip, which rests on a firm layer of soil or rock. They function like columns, bypassing weak soil layers to transfer the weight to competent, deeper strata.
- **Friction piles:** Also known as "floating piles," these transfer the load through the friction that develops between the pile's surface and the surrounding soil. This type is used when a hard, underlying stratum is too deep to be reached economically.
- **Combination friction and end-bearing piles:** In reality, most piles function using a combination of both end-bearing and friction to transfer loads to the soil.
- **Tension/uplift piles:** These piles are used to anchor structures against uplift forces caused by things like hydrostatic pressure, high winds, or overturning moments in tall, slender buildings.
- **Compaction piles:** These piles do not carry a direct structural load. Instead, they are driven into loose granular soil to increase its density, thereby improving its bearing capacity.
- **Sheet piles:** These are interlocking sections, usually made of steel, that are driven to form a continuous wall. They are not typically used for vertical load-bearing but rather for temporary or permanent retaining walls, cofferdams, and to protect riverbanks from erosion.

Based on installation method

- **Driven piles (displacement piles):** This method involves driving or hammering pre-formed piles into the ground. As they are installed, they push the soil outward and downward. Common materials include precast concrete, steel, and timber.
- **Advantages:** Can be installed quickly, increase the density and bearing capacity of surrounding granular soil, and do not require excavation or spoil removal.
- **Disadvantages:** Cause significant noise and vibration, making them unsuitable for sensitive areas or near existing structures.
- **Bored piles (replacement piles):** These piles are constructed by drilling a hole in the ground and then filling it with reinforced concrete. They are often used in urban areas to minimize noise and vibration.

- **Continuous Flight Auger (CFA) piles:** A common type of bored pile where a hollow-stemmed auger drills to the required depth, and concrete is pumped through the stem as the auger is withdrawn.
- **Driven and cast-in-situ piles:** This method uses a temporary or permanent steel casing that is driven into the ground. The casing is then filled with concrete. The Franki pile, which forms an enlarged base, is one example.
- **Screw piles (helical piles):** These consist of a steel shaft with helical plates that are screwed into the ground using a rotary drive mechanism. They produce minimal vibration and spoil, making them suitable for sites with restricted access or sensitive soil.
- **Micropiles (mini piles):** These are small-diameter piles used for underpinning existing structures or in locations with restricted access where larger equipment cannot operate. They can be driven or screwed into place.

Based on material

- **Concrete piles:** One of the most common materials due to its strength and durability. They can be precast (manufactured off-site and driven) or cast-in-situ (poured into a drilled hole on-site). Prestressed concrete piles are also used for high-strength applications.
- **Steel piles:** Available in various forms, such as H-piles and pipe piles. Steel piles have high strength and are ideal for deep foundations or heavy loads. They can be driven through difficult ground but are susceptible to corrosion.
- **Timber piles:** Made from tree trunks and used for lighter, temporary structures, especially in waterlogged conditions where the wood is consistently submerged. They are cost-effective but less durable than concrete or steel and prone to decay if not treated.
- **Composite piles:** These combine different materials, such as concrete and steel, to utilize the best properties of each. For example, a steel pile might be used at the bottom for penetrating hard ground, with a concrete section above for corrosion resistance and load-bearing.

5. **Explain well foundation and caissons.**

Ans:- A well foundation is a type of deep foundation, also called a **caisson**, used to transfer heavy structural loads to deeper, stronger soil or bedrock. They are typically large, hollow structures that are sunk into the ground by excavating the soil inside, and then filled with concrete for stability. The term "caisson" refers to the watertight retaining structure, and "well foundation" describes its common shape and application, especially for large projects like bridges.

Well foundation (caisson)

- **Purpose**: To transfer loads from heavy structures like bridges and high-rises through weak soil to more competent soil or bedrock below.
- **Construction**:
    - A hollow structure, called the "caisson," is constructed with a cutting edge at the bottom.
    - The caisson is sunk into the ground by removing soil from the inside while it is being built or sunk.
    - As the well sinks, more sections of the steining (the vertical wall) are added.
    - Once the desired depth is reached, the interior of the caisson is filled with concrete or sand, and a bottom plug is placed.
    - A top plug and a well cap are then added to distribute the load from the superstructure.
- **Key Components**: Cutting edge, curb, steining (the wall), bottom plug, top plug, and well cap.
- **Types**: Common types include single circular, double-D, rectangular, and dumb-bell shapes.

Caissons

- **Definition**: A watertight retaining structure that can be used as a foundation element.
- **Usage**: Employed in underwater or difficult soil conditions for foundations of bridge piers, dams, and other large structures.
- **Construction methods**:
    - **Open caisson**: A caisson open at both ends during sinking, where the soil is excavated from the inside. This is also called a well foundation.

- **Pneumatic caisson**: A caisson that uses air pressure to keep water out, allowing workers to excavate in dry conditions. This method can put workers at risk of decompression sickness.
- **Box caisson**: A large, pre-constructed, watertight box that is floated to its final position and then sunk and filled with ballast or other materials.

- **Advantages**:
  - Provides a solid and durable foundation for very heavy structures.
  - Can be used in a variety of soil conditions.

10 MARK QUESTIONS

1. **Explain the complete job layout procedure including site clearance and layout for both load bearing and framed structures with necessary precautions..**

   Ans:- Job Layout

   Job layout can be defined as a drawing of the proposed construction site which shows different locations such as entry point, exit point, equipment, and material stores, temporary facility, site office, and place where workers will stay. Temporary facilities are not part of exact construction but they are made up to support specific tasks such as mixing plant, maintenance and fabrication shops, storerooms, etc.

   Job layout helps us to plan the construction site in such a way that different construction resources like tools, machinery, materials, manpower, etc. can be arranged easily and optimal uses of construction space can be achieved. More complex the construction project or larger in scale detailed job layout is necessary as it helps in detailing and managing space on site. Following are the main purpose of job layout:

   - It helps in reducing the completion time for the construction.
   - It provides easy movement of equipment from one point to another.
   - It helps in reducing wastage and deterioration of the material.
   - It saves time by delivering and making a uniform flow of material at the site.
   - It provides more safety to the worker at the site.
   - The output from manpower and equipment can be increased using the job layout.

Factors Affecting Job Layout

A job layout is affected by numerous factors. The factors that affect a job layout are discussed as follows:

(1) Type of project: The type of project plays a very prominent role in making job layouts. The construction layout varies according to the project and its functioning. For example, if it is the construction of a mall then it requires a centrally located layout but if it is highway construction then it requires a number of the central layout at a suitable interval.

(2) Method of construction: The construction at the site may require a pre-cast structure or castin- situ or both. So, the job layout varies according to the requirements of the construction. For example, if there is a requirement for pre-cast structures, then a casting yard should also be present in the job layout otherwise there is no need of providing a casting yard.

(3) Availability of resources: Various resources such as manpower, machinery, material, etc. are equired at the construction site. So, the job layout should have the provision for the differen resources. The temporary arrangement of housing, food, or any other facility required should be given in the job layout. The location of the temporary facilities should be such that it remains safe from the adverse the impact of atmosphere.

(4) Temporary road: Roads are important to transfer material and equipment from one place to

another place inside the construction site. It also provide access to the entry and the exit point from nearby road. The transportation facility should be given consideration in the job layout.

(5) Miscellaneous facilities: There may be other facilities that need to be shown in the job layout. The necessary provision for facilities such as electricity, water supply, material storage yard, and telephone connection should be there in the site job layout.

Site Clearance:-

Site clearance is the process taken to prepare a building site for its construction. It involves the clearance of vegetation, dead root mats, living or dead trees, and subsoil for a minimum depth of 30 cm from the ground surface. Site clearance also involves the

work related to the demolition of any prior structure before the actual construction takes place. All depression occurs due to the removal of topsoil, vegetation should be filled with suitable material. It also involves the work related to leveling and making the ground ready for construction work to start. Site clearance work is carried out very carefully and safely and all approval had to take before dumping the material taken out from the site. If any type of contaminated material such as asbestos or any hazardous materials is present on site, then an expert for the disposal of this type of material should be consulted before the disposal of hazardous material

The following recommendations are considered during the process of the site clearance:

(1) The area to be cleared is marked properly.

(2) The trees and vegetation on the site are to be cleared off. The details of the trees to be cut should be listed and the trees and vegetation are removed manually or mechanically.

(3) The topsoil is excavated using the excavating equipment. The excavators are used for the removal of the soil.

(4) All the depressions and pits created during the process of clearing the trees and during the removal of the vegetation must be filled and compacted properly. The excavated soil is used for this purpose.

(5) The water can be used during the compaction of the pits. The density of the compacted pits should be near the surrounding area.

(6) If the structures exist in the area, these should be demolished mechanically. The demolition waste is dumped at the approved dumping sites, and the useful waste is stored properly. The soil that is excavated must be stored properly. These materials can be removed using tractors and dumpers.

(7) The ground can be leveled using the dozers if required.

Centre Line Method of Job Layout

The Centre line method is generally used for load-bearing structures that have a wall foundation of a similar cross-section. In this method, the center line length of all the layout structures is measured which have similar cross sections and the same type of foundation. The center line method helps in carryout work faster, but special attention

must be paid to cross walls, junctions, and crossing points of the partition wall.Some features of the center line methods are given as follows:

- This method proves easy for buildings having no cross walls.
- If the building is having cross wall and partition wall, special consideration is given to their junction
- If a building has a partition wall or two junctions of the cross wall then for each meeting point half of the breadth is deduced from the total center line.

The following steps are followed during the layout using the center line method:

- First corner of the building is fixed by measuring the distance of one corner from the border of the plot and fixing it by using wooden pegs.
- From this wooden peg, the center line of the foundation is marked.
- Then half the width of the layout foundation is marked on either side of the center line by a wooden peg.
- Considering the orientation of the building, the center line of the foundation is matched with the baseline string.
- The perpendicular line is set using the first corner center line wooden peg.
- Lime sand powder is used to mark the excavation line on either side of the center line

Face Line Method of Job Layout

- In the face line method, the marking by lime sand powder is done on the wall exterior and interior surface. The marked line is extended by 2 meters away from the excavated point.

The face line method are as follows:

- Step 1: Extended lines are to be marked for each wall exterior face by 1, 2, 3….so on.
- Step 2: The wooden pegs are used to mark this extended line for future reference as during excavation the face line will get disappeared.

- Step 3: The width of the wall between the wall face is excavated for the foundation.
- Step 4: Considering the orientation of the building, the face line of the foundation is matched with the baseline string.
- Step 5: The perpendicular line is set using the face line from the wall exterior marked by the wooden pegs.
- Step 6: Diagonal check such as distance between AC, BD, EG, FH, and so on must be checked for the proper rectangular shape of the rooms.

Precautions

The workers should care about some points while transferring the layout to the ground. The following precautions should be considered while making a layout on the ground:

- The steel tape used for the measurement should be free from any type of error. The steel tape should be checked for errors at regular intervals. As time passes, the steel tape can get elongated or shortened during the measurements. If there are errors in the tape, these should be corrected mathematically.
- The sketches of the location should be used with great care while fixing the boundaries of the
  plot.
- The dumpy level or the auto level should be used for the purpose of leveling. The level should be error-free and should be calibrated properly.
- The locations where the wooden pegs are to be installed must be properly marked. Any confusion can lead to errors in the job layout. The wooden pegs are kept on the same level and the markings on the wooden pegs should be clearly visible.
- The distance should be checked by at least two independent measurements.
- The rooms and the whole building should be checked for a diagonal check.
- The plumb bob should be straight while transferring the marking point on the ground. The inclination of the plum bob induces errors.
- The measurements of the distance, angles and elevations must be precise.

- The lime powder used for marking should visible clearly and distinct for proper excavation to avoid any confusion.

2. Explain deep foundations including pile foundation, well foundation, and caissons with detailed diagrams.

Ans:-

A deep foundation is the type of foundation that has more depth than its width. Deep foundations are of the following three types:

- Pile foundation
- Pier foundation
- Well foundation or caissons

Pile foundation

A pile may be defined as a slender long column made of timber, concrete, steel, or composite material that is used to transfer the load of the structure through its bottom or friction action or by a combination of both. The diameter of the piles is generally equal to or less than 0.6 m.

Based on the mechanism of transfer of the load, the piles may be classified further into the following three types:

(1) End bearing piles

(2) Friction piles

(3) Combined piles

The end-bearing piles transfer the superimposed load through their bottom tip. These piles act as a load bearing structure. These types of piles are used to transfer the load through the layer of water or soft soil to an underlying hard stratum.

Sometimes the hard stratum may lie under extreme depth and taking the piles to the required depth may prove uneconomical. In this case, friction piles can be used. The friction piles transfer

the superimposed load by their skin friction. The perimeter of the pile remains in contact with the soil and transfers the load to the soil around the circumference of the piles.

The combined piles transfer the load by the combined action of their bottom tip and body friction. These types of piles have greater bearing capacity. Normally combined action piles are used in the case of granular soil.

The piles can be made of different materials. The piles can be classified into the following four categories based on the material:

(1) Timber piles

(2) Steel Piles

(3) Concrete Piles

(4) Composite piles

The trunks of the trees are used for making the timber piles. The timber used for making these piles should be straight and has sufficient strength. The timber should be defect free. The major advantage of these piles is that the timber is easily available. The cost of this type of pile is less. The timber piles have lesser life as these are prone to termite attack. So, these types of piles are used for underwater construction. The bottom of the timber piles is provided with a steel cap so that it can be protected from damage.

The steel piles are strong in tension. These are provided in the form of pipes or H section. The steel piles are durable. These can be driven into the ground. These types of piles are easy to transport and can withstand rough handling. The bearing capacity of these piles is very high. If the ground conditions are very stiff and penetration is difficult, the steel piles can be a good alternative. These piles can be prone to erosion. Epoxy coating is provided for saving the steel piles from erosion.

The concrete piles have sufficiently strong and can withstand very heavy loads. The cement concrete is used to construct the concrete piles. These types of piles are either precast type or cast in situ type. The precast type concrete piles are prefabricated in plants and transported to the site.

These piles can be driven into the stratum. The concrete piles can be constructed on the site too. The bore holes are excavated and the concrete is poured to construct the bored piles.

The composite piles are made of more than one material. The concrete piles can be provided a steel cap at the bottom tip to enhance the penetration capacity. Similarly, the timber piles can also be provided with the steel caps. Sometimes the concrete pile is provided above water table and joined with timber pile below the water table.

Pier foundation

A pier is a drilled cylindrical column with a large diameter. If the diameter of the cylindrical structure is less than or equal to 0.6 m, it is known as drilled pile. If the diameter of the bored pile is more than 0.6 m, it is called a pier. A pier transfers the load in the same way as a pile does. The load can be transferred by the bottom end or skin friction or by the combined action. The heavy axial loads are vertically transferred by piers. A pier may be used instead of a number of piles which leads to the ultimate economy.

A pier can be provided as a straight shaft or a bell can be provided at the bottom. If the hard stratum lies within 5 m below the ground level, a straight concrete pier can be used for the transfer of the superimposed load. If the hard stratum is deeper than 5 m, the bottom of the pier can be enlarged in the form of a bell. The angle of the bell portion is kept around 60º.

The drilled piers require strict supervision during the concreting. The construction of the piers requires highly skilled workmanship. There is a need of conducting extensive subsurface explorations before the construction of piers. The excavation is to be done very carefully during the construction of piers as there is a chance of subsidence or soil failures.

Caissons

Caissons are box or cylindrical type structures that are hollow in nature. The caissons are fabricated on the ground and penetrated at the waterbed. The caissons are used to support the bridges in the water bodies. The caissons are of the following three types:

- Open caissons or well foundation
- Floating caissons

- Pneumatic caissons

The open caissons are also known as well foundations. The open caissons remain open from the top and the bottom. The bottom of the open caissons has penetrating cutting edges which help it in penetrating through the bottom of the river, canals, harbours, or other water bodies. During underwater construction, the biggest challenge is to keep the water away from the construction site. Open caissons can fulfill this purpose too. The open caissons help in the construction of piers under the bridges. The open caissons are used for the construction on soft soils. These can be made of steel or concrete.

The floating caissons are closed at the bottom portion while they are open at the top. The open caissons are light in weight and are constructed on the ground. These are also hollow in nature. The floating caissons are floated to the destination where these are to be installed. The floating caissons are sunk into the underwater soil bed by increasing their weight. The weight of the floating caisson is increased by filling it with sand, rocks, concrete, etc. The floating caissons are not penetrated in the ground but are sat on the level surface. These are stable because of their weight.

The pneumatic caissons are constructed on the ground and these contain some working chambers. The working chamber is facilitated by a compressed air mechanism that helps in the prevention of entry of water into the working chamber. The airlocks are provided in the pneumatic caissons. Pneumatic caissons are very difficult to place at the desired location.

There are two shafts in a pneumatic caisson. One is used to enter the working chamber and the other is used to extract the excavated material. The compressed air is induced into the working chamber and the water is excluded. The pressure at the entry of the system is kept equal to the atmosphere.

As the labourers enter, the pressure is increased gradually. The workers come to the working chamber through the ladder. As the water is excluded by the compressed air, the workers can excavate in a dry environment. As the caisson is penetrated at the desired depth, the concrete plug is constructed that seals the pneumatic caisson at the bottom.

UNIT-3: Construction of Superstructure

2 MARKS QUESTIONS

1. Define facing and backing in stone masonry.

- **Facing** - Exterior visible surface of masonry wall.
  - Formed by well-dressed stones for aesthetic appearance.
- **Backing** – inner portion of wall behind the facing.
  - Made of rough stones or inferior quality material.
  - Both are bonded together using through stones or headers.

---

2. What is a through stone?

- Long stone extending from front to back face of wall.
- Provided at 1–1.5 m intervals horizontally and vertically.
- Ensures proper bonding between facing and backing.
- In thick walls, may be replaced by pair of overlapping stones.
- Improves stability of masonry.

---

3. Differentiate between header and stretcher in brick masonry.

Header	Stretcher
Brick laid with its end facing the wall face	Brick laid with its length parallel to wall face
Shows smaller face (end) on elevation	Shows longer face on elevation
Used to bind two wythes together	Used to form facing course
Common in header and English bonds	Common in stretcher bond

---

4. What is a closer in brick masonry?

- Brick cut along its length to break joint alignment.
- Placed near quoins (corners) for bonding.

- Types: queen closer, king closer, bevel closer, mitred closer.
- Ensures vertical joints are staggered.
- Used in English and Flemish bonds.

---

5. Define bond in masonry.

- Arrangement of bricks or stones to ensure interlocking.
- Provides strength, stability, and uniform load distribution.
- Avoids continuous vertical joints.
- Types: header, stretcher, English, Flemish, etc.
- Essential for wall integrity.

---

6. What is a frog line in brick masonry?

- Frog – depression on top of brick.
- Frog line – string line marking alignment of frog faces.
- Maintains level and straightness of courses.
- Ensures uniform mortar joint thickness.
- Used for proper brick course alignment.

---

7. List types of rubble masonry.

- Random rubble masonry (uncoursed and coursed)
- Squared rubble masonry
- Polygonal rubble masonry
- Dry rubble masonry
- Flint rubble masonry

---

8. What is ashlar masonry?

- Masonry using finely dressed (ashlar) stones.
- Stones of uniform size and thickness.
- Very thin mortar joints (<6 mm).
- Used in high-quality and monumental buildings.
- More expensive than rubble masonry.

---

9. Define scaffolding.

- Temporary framework of poles and planks.
- Used to support workmen and materials at height.
- Essential during masonry, plastering, and painting.
- Made of bamboo, timber, or steel tubes.
- Removed after completion of work.

---

10. What is shoring?

- Temporary support given to structure or trench wall.
- Prevents collapse during excavation or repair.
- Made of timber or steel members.
- Types – raking, flying, and dead shoring.

5 MARKS QUESTIONS

1. Explain the terms used in stone masonry.

- **Bed:** Horizontal surface on which stone rests.
- **Build:** Vertical face perpendicular to bed.
- **Course:** Horizontal layer of stones.
- **Bond stone (through stone):** Stone connecting facing and backing.
- **Quoin:** Corner stone at external angle.
- **Header and stretcher:** Stone positions for bonding.
- **Joints:** Mortar-filled gaps between stones.
- **Backing:** Inner portion of wall behind facing.
- **Hearting:** Core filling between faces.
- **Diagram:** Section of stone wall showing facing, backing, hearting.

2. . Compare stone masonry and brick masonry

- The stones are available naturally while the bricks are manufactured in the plants.
- The stones require dressing and modification in their raw form. The edges and sides are to be dressed properly in stone masonry while the brocks can be used as it is. There is no need of dressing in the case of bricks.
- The size of the bricks remains uniform throughout the construction while the size of stone masonry is non-uniform.
- The weight of the stones is more as compared to the bricks. So, the handling and transportation of the stones are complex while the bricks can be transported easily.
- The minimum thickness of a wall for stone masonry is 35 cm while the minimum thickness of brick masonry is 10 cm.
- The amount of mortar required in the stone masonry is more than the brick masonry due to the irregularity of the shape. The lining of the mortar remains thicker in the case of stone masonry.
- Stone masonry is more durable and it can withstand the action of external agencies in a better way as compared to brick masonry.

- The brick masonry offers more resistance to fire.
- Stone masonry doesn't require plastering while brick masonry requires a surface finish and plastering.
- The sewage, urine, human excreta, etc., damage the brickwork. So, brick masonry can't be used where it can come in contact with such types of waste.
- The bricks emit more heat as compared to the stone masonry.

3. Explain Hollow concrete block masonry.

Ans:- The concrete blocks are made of ordinary Portland cement and aggregate. High-density blocks are fabricated using cement, sand, and gravel. The concrete blocks can be categorized in solid concrete blocks and hollow concrete blocks. In the solid concrete blocks, the cavity is not provided or remains below 25% of the gross cross-sectional area. In the hollow concrete blocks, one or more cavities are provided and it can be up to 50% of the total gross cross-sectional area.

The advantages of the hollow concrete blocks are as follows:

- The hollow concrete blocks can be manufactured in large sections .
- These are light in weight due to the cavity. So, the handling and placing of the hollow concrete blocks are easy.
- The construction of structures with hollow concrete blocks is quick and easy. It consumes less time in construction.
- The buildings can be made earthquake-resistant using hollow concrete blocks. For this purpose, these blocks can be reinforced with steel bars and concrete.
- These blocks provide good acoustic and thermal insulation due to the availability of the cavity.
- The cavities in the hollow concrete blocks are used for the installation of electrical setup and plumbing systems.
- The production cost of the hollow concrete blocks is slightly lesser than the bricks. These blocks consume less mortar as compared to bricks.
- The maintenance cost of the hollow concrete blocks is lesser.
- There is no need for formwork like in the case of construction of concrete members.

The hollow concrete blocks are divided into A and B grades. If the minimum density for the A-grade hollow concrete blocks is 1500 kg/m3. For B-grade blocks, the density varies from 1100 kg/m3 to 1500 kg/m3.

4. Describe precautions in brick masonry construction.

Ans:- Construction using brick masonry requires great care as the quality of the work depends on many factors. The precautions to be considered during the construction with brick masonry are discussed as follows:

(1) Soaking of bricks: The bricks used in the construction should be saturated in the water properly. The bricks should be soaked in water at least for a duration of 12 hours. However, the soaking time depends on the quality of the bricks. If the bricks are not saturated, they can absorb water from the mortar which can make the bond weak.

(2) Beds and joints: The bottom surface of the bricks should lie on the mortar properly. There should not be any inclination of the bed with respect to the mortar line. The pressure coming to the brick must be perpendicular to its bed. The bricks should be laid on their bed and the frog of the bricks should be in the upward direction. If the frog remains in the downward direction, it will reduce the wall's strength due to improper use of the frog. The joints should be filled with mortar in a proper manner. The thickness of joints should be uniform throughout the construction. The joints form the weakest part of the wall. So, the two joints should never be in the same line.

(3) Verticality: The wall constructed should be truly vertical. The verticality of the wall can be tested with the help of plumb bob and spirit level. If the wall is not vertical, it should be reconstructed.

(4) Wetting of bed: If the construction of the wall begins from an already constructed part, the bed of the previously constructed part is to be wetted with water properly. The water pipe can be used for wetting the bed of previous construction. It will help in establishing a strong bond between new and old work.

(5) Toothing: If there are plans for construction in the future, the toothing can be provided. When the walls cross each other, the extension of bricks is provided in the wall so that when

future work begins it can make a good bond with old construction. The figure 3.30 shows the toothing.

(6) Height of the wall: The difference between the heights of the walls constructed in a day should not be more than 1 m. This limitation is suggested to prevent the differential settlement of the foundation.

(7) Watering: After the construction, the wall should be watered for time until the mortar sets properly. For the cement mortar, the watering is done for 7 days to 14 days while for lime mortar the watering is done for 14 days to 21 days.

5. Explain English bond with neat diagram.

Ans:- Header and stretcher course are present alternatively in English bond. In this type of bond, the vertical joints present in the header course and stretcher course come in the same line throughout the wall. For disturbing the continuity of vertical joints in the consecutive course it is necessary to have the queen closer after the header quoin in each header course. Half bat or three-quarter bat brick is not used in the construction of English bond. This bond is simple to construct and stronger than all other bonds. Wall can be constructed fast by using this bond as compared to other bonds. Walls of any thickness can be constructed using English bond. Different arrangements of English bond for even and odd course for different thickness. Queen closers help in breaking the continuity of vertical joints.

Some additional points for the construction of English bond masonry are given as follows:

(1) A queen closer is never used at the start or at the end of the header course as it will easily lodge from its position.

(2) In stretcher courses, the minimum overlap of the stretcher is kept 1/4th the length of the brick over the header.

(3) A wall with a thickness equal to an even number of half bricks (1 brick, 2 brick, 3 brick thick wall, and so on) will have a similar appearance on the outer and inner faces of the wall i.e. a header course will have header face on the front and back face. A similar situation will occur in the stretcher course.

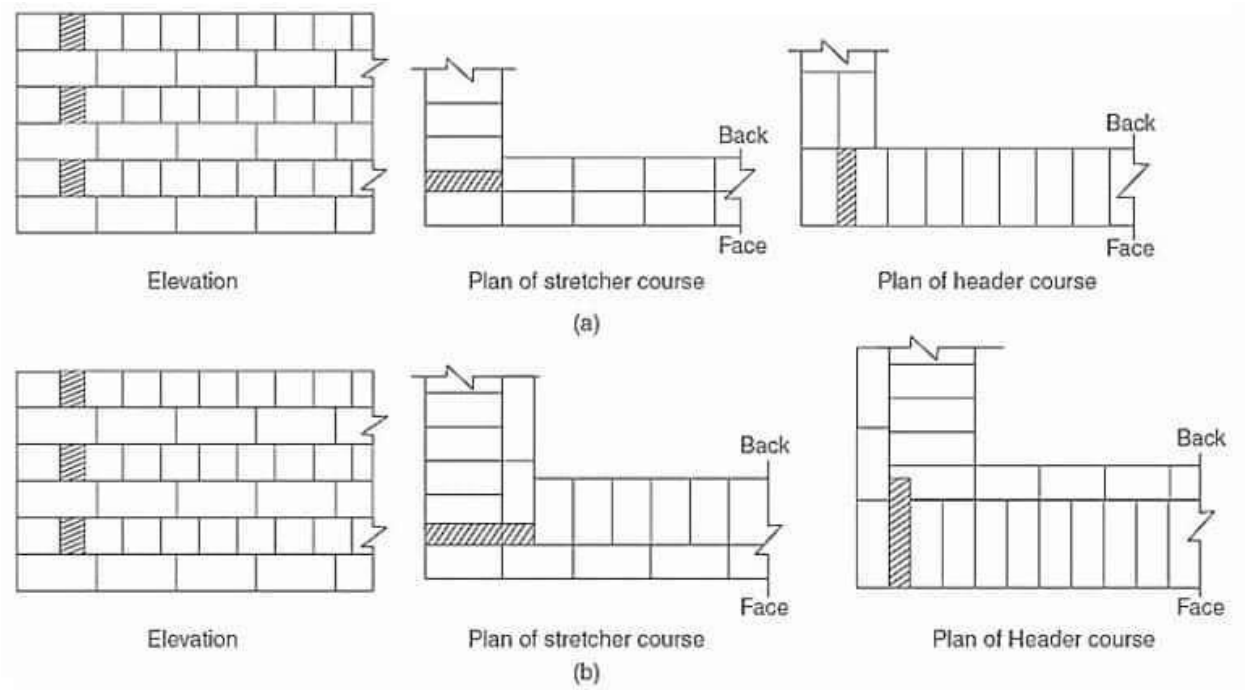
(4) The walls with a thickness equal to an uneven number of half bricks (11/2) brick and(21/2) brick thick

wall and so on) will show stretcher face on one side and header face on another side in the same

course.

(5) When the thickness of the wall is equal to 2 bricks or more, the central part of a bond will have a header placed in both the header and stretcher course. It is done so to prevent the continuous vertical joint in the wall

(6) Vertical joints in the header course are thinner than vertical joints in the stretcher joint it is done because the number of joints in the header course is double the number of joints in the stretcher course.



10 MARKS QUESTIONS

1. Describe scaffolding including purpose, types, erection, dismantling.

Ans:- Scaffolds are temporary structures constructed for supporting the workers and the materials. The scaffolds are platform-like structures that are used for structures with a height of more than 1.5 m. The scaffolds are removed once the construction of the building component is over. The failure of scaffoldings is life-threatening for the works. So, the scaffolds should be stable in adverse environmental conditions like rain, storm, etc. The method of construction of the scaffolds is known as scaffolding.

The scaffolding is used for the following two purposes:

(1) Scaffolding provides a place for the worker or labourer so that they can lift up the construction. The artesian can work up to some limited height without support. Scaffolding provides elevated space for extending the work to the required height.

(2) Scaffolding provides space for keeping the material near the artesian at elevation.

Types of scaffold

The scaffolds are constructed using bamboo poles, ropes, boards, etc. The members used in the construction of the scaffolds are as follows:

(1) Standards are the vertical members. These are supported on the ground or penetrated into the ground.

(2) Ledgers are the horizontally running members and remain parallel to the wall. These are tied to the standards.

(3) Braces are the diagonal members and these are fixed on the standards.

(4) Putlogs are the transverse members that remain perpendicular to the surface of the wall. These are supported by the wall at one end and the other end is supported by ledgers.

(5) Scaffold boards are placed horizontally to place the material and support the workers.

The different types of scaffolds have their own suitability and limitations. The selection of a scaffold is based on the loading condition, field condition, type of work, and budget. The following types of scaffolds are used based on the different types of masonry work and the shape of the wall:

(1) Single scaffold

(2) Double scaffold

(3) Cantilever scaffold

(4) Suspended scaffold

(5) Trestle scaffold

(6) Steel or tubular scaffolds

Single Scaffold

The single scaffold is also known as a brick masonry scaffold. One end of the scaffold rests in the holes of the walls and the other end is supported by the standards. The standards are penetrated into the ground. As the scaffold is supported by the standards on only one side, it is known as a single scaffold. The following points are considered during the construction of a single scaffold:

- Single scaffolds are used for ordinary buildings.
- The components of the scaffolding are arranged parallel to the wall at a distance of around 1.2m
- The standards are placed at a distance of 2 m to 2.5 m.
- The ledgers are connected to the standards at a spacing of 1.2 m to 1.5 m.

Double Scaffold

It is very difficult to provide holes in the wall for inserting the putlog. So, a double scaffold is provided which is stronger in nature. It is also known as mason's scaffold. In double scaffolding, two rows of scaffolds are used. The first row of the scaffolds is placed at 20 cm to 30 cm from

the wall while second row is placed at 1 m away from the wall. The scaffolding is given more support by rakers.

Cantilever Scaffolding

A cantilever scaffolding is also known as needle scaffolding. The cantilever scaffolding is used when the ground is weak and can't support the standards. The cantilever scaffolding is used when the standards can't be supported on the ground due to some obstruction or traffic. The needle supports the scaffold structure and it is braced. The cantilever scaffolding can be of single frame or two frame type .

A single frame cantilever scaffold is supported by a wall at one end and standards by another end. The needle passes through the wall and the strut is supported at the base of the wall. In a double frame cantilever scaffold, the strut is supported on the floor due to the weakness of the ground.

Suspended Scaffolding

The suspended scaffolding is used for small works like painting and finishing the walls. The working platform is suspended in air. The platform is supported by chains and ropes at the roof. The platform provides flexibility as it can be adjusted at any level with the help of ropes or chains. This type of platform is light weighted. If the elevation is high, the suspended scaffolds are the most economical solution. The suspended scaffolds can be fixed to the trusses on the roof or these can be suspended by pulleys. The pulley or crane-based suspended scaffold can be more flexible which can vary the level of platform based on their requirement.

Trestle Scaffolding

Trestle scaffolding is also known as ladder scaffolding. The working platform is mounted on the tripods or ladders. These tripods or ladders may move with the help of wheels. Such types of the scaffold are suitable for only up to 5 m in height and can be used for light works. These are used for painting and small repair purposes.

Steel Scaffolding

The steel scaffolding is the same as timber scaffolding and may have similar arrangements as discussed in previous sub-sections but the members of the scaffolding are made of steel. Steel gives more tensile strength and can take higher loads. Steel tubes are used instead of timber in this type of scaffolding.

Process of erection of scaffolding

The correct erection of the scaffolds is very important for safe construction. The scaffolds should be erected carefully and the work should be conducted under the supervision of the experts. The supervisor is responsible for checking and maintenance of the scaffolds. The following procedure is followed for the erection of scaffolds:

(1) The first step is to prepare the foundation at which the scaffolds are to be supported. Weak soil or mud is replaced by gravel. The ground is excavated instead of backfilling. If the soil is weak, cantilever scaffolding is selected. The cantilever scaffolds are supported on the floor through a needle and strut arrangement. The soil should not be disturbed excessively.

(2) The equipment for the erection of the scaffolds must be placed near the place of work. The equipment should be unloaded in the pattern of use.

(3) The frames are erected safely. The elements of the scaffolds like ledgers and braces are properly

connected. The joints are properly locked and inspected. The elements of the scaffolds should not have deteriorated.

(4) The erection of the frames must be under the strict supervision of the experts. The supervisor must check the scaffolds for proper jointing.

(5) The alignment of the frames should be checked. The alignment must be proper for each level of the scaffold.

(6) The putlogs are placed on the ledgers and joined properly. The joints are inspected by the supervisor

(7) In the case of suspended scaffolds, the chains, pulleys, etc. are planned and inspected by the supervisor.

(8) After the erection of the scaffolds, a final inspection is conducted. The scaffolds require daily inspection due to safety reasons.

(9) The supports under each leg should be inspected. If the level of support is not proper, action should be taken.
(10) Frames should be checked for alignment using the plumb bob.
(11) All the ties and braces must be inspected for locking

Dismantling of scaffolding

As it is mentioned that the scaffolds are temporary structures, so these are to be removed when the work is completed. The dismantling of scaffolds involves equal risk as the erection of the scaffolds.

The dismantling of scaffolding is done as follows:

(1) The scaffolding is checked for structural stability. If it seems unsafe at any part, that part is reconstructed before beginning the dismantling procedure.
(2) The dismantling is done from top to down.
(3) The workers should work at least on the two planks placed in tier of frames.
(4) The ties should not be removed until the level of scaffolding to which they are attached is reached. The planking should be moved downwards as the dismantling progresses.
(5) The workers should not climb the standards or braces. They should remained inside the scaffolding.
(6) The fastening items should be removed from the bottom of the frames.
(7) The scaffolding components are lowered carefully without dropping them roughly

2. What is Formwork? What are the requirements of formwork? Describe different types of formwork.

Ans:- The concrete can be cast in any desired shape but at the time of pouring concrete has very less shear strength. So, during the time poring it requires support to maintain the desired shape. Formwork may be defined as the temporary support to keep the concrete in its place. This temporary support is provided until the concrete achieves sufficient strength to bear its own weight. The formwork is kept strong enough to sustain the load of the wet concrete.

At the time of removal of formwork, it should be able to withstand the load of labourer. If the formwork is deformed during the setting of the concrete, the shape of the structural member is also deformed which is very difficult to improve later.

REQUIREMENTS OF FORMWORK

The formwork plays an important role in the construction of the concrete members in the desired shape. The formwork should have the following characteristics:

(1) **Ease of removal:** A good formwork is always easy to remove. If the formwork requires excess hammering for removal, it may damage the corners and edges of the structural member. So, the formwork should be designed in a way that it can be removed easily with minimum hammering.

(2) **Dimensions:** The dimensions of the formwork should be according to the structural components of the building. The dimensions are carefully considered and the internal dimension should be kept in mind while designing the formworks. The shape and dimension of the formwork can be planned from the drawings and plans of the building.

(3) **Economy:** The formwork should be cost-effective. The purpose of the formwork is just to keep the concrete in shape and it doesn't contribute to the stability and strength of the structure. So, the design of the formwork should be economical. The cost of the formworks can be 20% to 30% of the total cost of the concrete structure. The cost may vary based on the complexity of the structure and can reach even up to 60% of the total cost of the concrete structure.

(4) Rigidity: The formworks should be able to withstand the deflections. These should be sufficiently rigid to face the deflections induces. The maximum deflection in formworks for the surface work is 1/300 of the span while for the hidden surfaces it is 1/150 of the deflection.

(5) Strength and durability: The formworks should be sufficiently strong to withstand the loads. They should be able to bear the load of the poured and wet concrete. These should be strong enough to take the impact of the hammers and load of a person while removing them. The formworks are reused for other works. So, these should be able to withstand the impact of weather and temperature.

(6) Reusability: As discussed before, the formworks are reused many times. So, the formworks should be reusable in nature. They should not show variation in their characteristics after using those one or two times. They can be used multiple times.

(7) **Leakage:** The joints of the formwork should be tight to prevent the leakage of the water. It is evident that the concrete mix is designed for particular water content. If the water from the formwork leaks in excess, it can vary the properties of the concrete itself.

(8) **Finish of surface:** The inner surface of the formwork should be smooth. The oiling of the inner surface is done for achieving a smooth surface.

TYPES OF FORMWORK

The formworks are classified based on the material. As discussed in the previous section, different types of material can be used for formworks. The materials for the formwork have different characteristics and their own advantages and disadvantages.

1.Timber Formwork

Timber is used most of the time for formworks. It is easily available and can be cut into any desired shape. The timber used for the formwork should be free from any defects. There should not be any knot in the timber. Softwood is generally used for making formworks. The hardwood is very difficult to cut and also it resists the nailing process. If the wood is excessively dry, it creates an uneven surface. So, a partially treated softwood is preferred for formworks. Pine, kail, cedar, etc. can be used for making formworks. Timber as a material for the formwork offers the following advantages:

(1) The timber shuttering is light in weight. It can be transported and placed easily.

(2) Timber formworks are easy to install and remove.

(3) It is easy to cut timber in any desired shape.

(4) The timber for formwork is easily available as timber is a universal material.

(5) The timber formwork is economical for small projects.

The timber formwork has less durability as compared to other types of formwork. The termite attack is common on the timber formwork. So, the coatings for termite attack prevention are provided. The surface of the timber is not as smooth as plastic and steel.

.2 Plywood Formwork

The plywood is made by gluing the sheets of plies in multiple numbers. Plywood is the advanced version of timber. The durability of plywood is more than timber and the plywood formwork can be used more times as compared to timber formwork. The plywood formwork offers the following advantages:

(1) The surface of the plywood is very smooth as compared to the timber formwork. So, the members constructed using plywood formwork show a very smooth surface finish.

(2) The durability of the plywood formwork is higher than timber formwork.

(3) The plywood formworks can be installed easily as compared to the steel formworks

The weight of the plywood formwork is more than timber formwork while these are lighter than steel formwork. These require care at the time of installation and removal as these can get damaged by hammering.

3 Steel Formwork

The fabricated steel sections are used for making the steel formwork. Steel formwork is installed using bolts and clamps. The initial cost of the steel formwork is high but in long run these are economical. The major advantages of the steel formwork are as follows:

(1) The strength of steel formwork is very high. It can take heavy loads.

(2) The dimensions of the steel formwork are not affected by moisture or water. These don't shrink or expand due to the action of water.

(3) The surface of the steel formwork remains smooth.

(4) Steel formwork is highly durable. They can be used in more repetitions as compared to other types of formwork. They can be used more than 100 times.

(5) The steel formwork can be made watertight and the loss of water during formwork can be avoided using steel formwork.

The steel formworks are expensive comparatively. If the small nuts or bolts are missing, the formwork gets delayed. The major problem with the steel formwork is corrosion. So, treatment for the prevention of corrosion is required.

4 Plastic Formwork

Plastic formwork are made from good quality plastic with an interlocking facility. These type of formwork are light in weight and can be used multiple times. These can be fabricated in any desired shape. The plastic formwork offers the following advantages:

(1) The handling cost of the plastic formwork is less due to its lightweight. The transportation and placing of the plastic formwork are easy.

(2) Plastic formwork is easy to install but should be installed carefully.

(3) The durability of plastic formwork is good. It is not affected by water or air.

(4) These are economical due to their repetitive usage.

.5 Aluminium Formwork

In aluminium formwork, fabricated sections of aluminium are used. The advantages of aluminium formwork are the same as steel formwork. It is lighter in weight as compared to steel

formwork. The strength of the aluminium is sufficient to take the heavy loads and these can be fabricated in any desired shape.

UNIT-4: Building Communication and Ventilation

2 MARKS QUESTIONS

1. What is horizontal communication in buildings?

5. It refers to movement or access provided between rooms or areas on the same floor level.
6. Achieved through doors, windows, corridors, and passages.
7. Ensures free movement of people, air, and light.
8. Enhances accessibility and ventilation.
9. Includes external and internal doorways.

---

2. List components of doors.

10. Frame
11. Shutters
12. Styles
13. Rails (top, bottom, lock rails)
14. Panels
15. Hinges and other fixtures.

---

3. What is a flush door?

16. A door having a smooth surface on both sides.
17. Made by fixing plywood or veneer over a solid or hollow core.
18. Lightweight and economical.
19. Easy to clean and termite-resistant.
20. Commonly used in residential buildings.

---

4. Define rolling shutter.

21. A type of door consisting of thin steel slats forming a curtain.
22. The shutter moves vertically upward or downward.
23. Operated manually or mechanically.
24. Used for shops and garages.
25. Provides security and ease of operation.

---

5. What is a bay window?

26. A window projecting outward from a building wall.

27. Provides wider view and additional seating space.

28. Increases light and ventilation.

29. Adds aesthetic value to the façade.

30. Usually polygonal or square in plan.

---

6. Differentiate between door and window.

Door	Window
Provides access for entry/exit	Provides light and ventilation
Reaches floor level	Positioned above sill
Operated frequently	Operated occasionally
Supports locking	May or may not have locking

---

7. What is a ventilator?

31. Small opening near roof level.

32. Provided for circulation of air.

33. Helps remove hot air and fumes.

34. May have glass louvers or grills.

35. Usually fixed type.

---

8. Define window sill.

36. Horizontal projection at the bottom of a window opening.

37. Supports window frame.

38. Protects wall from rainwater.

39. Made of stone, RCC, or brick.

40. Sloped outward for drainage.

---

9. What is a chajja?

41. A projected slab or covering above a window or door.

42. Prevents rainwater entry.

43. Usually made of RCC or stone.

44. Common in tropical regions.

45. Improves elevation appearance.

---

10. What is vertical communication?

46. Means of movement between different floors.

47. Achieved by staircases, ramps, lifts, and escalators.

48. Essential in multi-storeyed buildings.

49. Provides accessibility and safety.

50. Integrated with building circulation plan.

---

11. Define tread and riser in staircase.

- Tread: The horizontal upper surface on which a person steps.
- Riser: The vertical portion between two consecutive treads.

---

5 MARKS QUESTIONS:

1. Explain the components of doors.

Ans: A door may be defined as an open part in the wall, which is left for providing access to the persons in the building. The various components of the door are explained as follows:

- Frame: It consists of vertical members and horizontal members forming a structure, to which shutters are attached.
- Shutters: The shutter is the part of the door which is movable and can be opened. It consists of panels, rails, styles, etc. Shutters are fixed into the frame. It provides ventilation and light inside the room.
- Head: Horizontal member which is on the top or uppermost part of the frame is known as the head.
- Horn: Horizontal member which is projected outside the vertical member of the frame is known as the horn. It helps in fixing the frame into the openable part of the wall. The projected length is kept around 10 to15 cm.
- Style: Vertical outside member of the shutter which helps in connecting the shutter to the frame with the help of the hinge.
- Top rail: Horizontal member present on the uppermost part of a shutter is known as a top rail.
- Lock rail: Horizontal member present in the middle of a shutter is known as a lock rail. This part of the rail consists of the locking arrangement of the door.
- Bottom rail: Horizontal member present on the lowermost part of a shutter.
- Intermediate or cross-rail: Additional horizontal members present in a shutter other than top and bottom rails. Horizontal members lie in between the top and the lock rail known as the frieze rail.
- Panel: An enclosed area between the adjacent rails and styles of a shutter.
- Mullion: Vertical member of a shutter, which helps in sub-divide the door shutter holdfasts is known as a mullion.
- Holdfasts: Holdfasts are made up of mild steel flat of section 30×6 mm. Z-shape is formed by bent the mild steel fast to fix or hold the frame into the openable part of the wall. Holdfasts are completely embedded into the wall opening. The horizontal length which is embedded inside the wall is kept around 20 cm.

- Rebate: Some depression or recess are made in the door frame to fix the door shutter. This depression or recess is known as a rebate.
- Jamb: Vertical face of the openable part of the wall which supports the door frame.

2. Explain sliding windows and louvered windows

Ans:-

Sliding Windows

The sliding windows consist of shutters that can move horizontally or vertically with the help of roller bearings.

The sliding windows have the following salient features:

- A sliding window is very easy to operate. Senior citizens and physically handicapped people can use sliding windows as these require less force to open and close due to the roller-bearing mechanism.
- A sliding window is provided with high-quality glazing that makes it highly energy efficient.
- It can act as a barrier to sound and a good insulator of heat.
- Aluminium is used in sliding windows generally. The sliding window frames have the ability to hold large glass sections, which maximizes their viewing capacity.
- Due to the large glass area, the sliding windows provide a good amount of natural light in the room.
- The sliding windows require less maintenance comparatively. However, the durability of the window depends on the material used in the window frame and the quality of the glass.

Louvered Windows

The louvered windows have louvers or blades that can be adjusted at any equal angle. When it is closed it gives an equal amount of air throughout the room and privacy is maintained. The blades in the louvered windows can be fixed or adjustable. In the case of fixed blades, these are kept at an angle of 45º. The inclined blades help in draining the rainwater too. The louvered windows can be used in toilets, bathrooms, and factories.

The louvered windows have the following salient features:

- The louvered window provides the facility for the passage of air and light uniformly. The flow of air is maintained in the room even if it is closed.

- The flow of the air can be controlled in the building if the blades of the window are movable in nature.
- The louvered windows are easy to clean. These can be cleaned from the inside of the room.
- This type of window can customize the privacy of the residents. The louvers can be inclined at any desired angle.

3. Write down the advantages and disadvantages of flush door.

Ans:- Flush doors are commonly used in residential, commercial and public buildings as they have smooth surfaces which give attractive appearances and construction is simple, cost-effective and provides better durability. Flush doors are made up of plywood or face veneers at outer surface and inner core is filled with solid or semisolid cardboard or hardwood. The advantages of flush doors are enlisted as follows:

- Cost of construction is less as compared to other type of doors and easily available.
- They are rigid, have high strength and resistant to impact.
- Weight of door is less as compared to plywood door and easily installed.
- These doors can be used as exterior as well as interior door.
- Attractive in appearance and decay-proof

The disadvantages of flush doors are enlisted as follows:

- These doors are difficult in repair due to defects caused by moisture, temperature etc.
- These doors are manufactured in factory, so available in standard sizes and difficult inalteration.
- These doors are not used where door are exposed to rain and sun directly.

4. What is Sill and Lintel of Window? Write down functions of Sill and Lintel.

Ans:- A window sill is constructed at the bottom of the window and is like a shelf under it. The window sill are provided for the following functions:

- The window sill provides a base for the window and its frame. The sill acts as a rigid base which provides stability to the window.
- It provides a slope to drain off the rainwater. The sill helps in the prevention of the entry of water into the room.
- The window sill can be used for different purposes. It can be used for placing decorative pieces.

A window sill is made of reinforced cement concrete however, a stylish and fancy material is provide as a covering to the sill. The granite stone or tiles can be provided on the sill. Stone can be use for providing the sill covering as it provides a smooth surface for placing the decorative on the sill.

A lintel is a beam-like structure that is provided above the window. It takes the load of the bricks above the window. The lintel is provided for the following functions:

- The lintel act as a tie beam that transfers the load of the masonry above the window to the surrounding masonry.
- The lintel acts as a damp-proof course (DPC) and prevents the penetration of water.
- The lintel supports the chajja or sheds.

As the lintels are beams, different materials can be used to construct the lintel beams. Timber is used as lintels since a long time. A bearing of 150 mm to 200 mm is provided for the timber lintels. These types of lintels are prone to fire hazards and can be attacked by insects. Steel beams are also used as a lintel. The steel beams are light in weight and can be handled easily. The transportation and placement of the steel lintel are easy. It has high tensile strength. The steel can be moulded into any required shape. The steel lintels are prone to corrosion and should be provided with anti-rust coatings.

Nowadays, reinforced cement concrete is used for the construction of lintel beams. It is very strong and can take the tension and compression loads. The steel lintels can be pre-casted or cast on-site. The concrete lintels are durable.

5. Explian briefly about Ventilators.

Ans:-An adult breathes at least 16 times in a minute. The air in the buildings can get polluted due to the CO2 produced by humans, outdoor pollution can enter the house and the equipment like furniture. In a home, the residents require clean air. In industrial buildings, indoor pollutants are to be excluded from the building. So, ventilators are provided to remove the contaminated air from the building.

The ventilators are the same as small windows but they are provided about 30 cm to 50 cm below the ceiling. The ventilation in the building can be provided using the following techniques:

(1) **Natural ventilation:** A small window is provided below the ceiling for the purpose of natural ventilation. The difference between the pressure due to wind and the temperature

difference due to the inside and outside of the building helps in creating natural ventilation. Natural ventilation can offer a sufficient flow of air throughout the building. However, the natural ventilation is subject to change due to external atmospheric conditions.

(2) Mechanical ventilation: As we know that natural ventilation depends on the outside condition of the atmosphere. So, mechanical ventilators can be provided to extract the contaminated air from the inside of the building. The pressure difference is created by a dynamic fan in the case of mechanical ventilation. The exhaust fans in the bathrooms and toilets are examples of mechanical ventilators.

(3) Hybrid ventilation: It is evident that natural ventilators save energy but depend on atmospheric conditions. So, a combined system with natural and mechanical ventilation is provided which is known as a hybrid ventilation system. A window with the exhaust fan can be provided in the case of hybrid ventilation.

10 MARKS QUESTIONS

1. What is staircase? Write down different parts of staircase. Describe different types of staircase.

Ans:- A staircase is known as the overall area that includes the steps, handrail, landing, etc. the. The different terms that are used in designing and constructing the staircase are discussed as follows:

(1) Tread: A tread is the horizontal portion of the stair which is used to climb the stairs. The tread accommodates the foot and hence should be of sufficient width. The typical width of the human foot is 23 cm.

(2) Riser: The vertical member between two consecutive treads is known as the riser while the height of the riser is known as the rise.

(3) Step: The combination of tread and riser is known as a step.

(4) Nosing: It is the extending edge of the tread. The nosing of the tread provides an aesthetically pleasing appearance and also increases the area of the tread. However, the nosing should not be provided in the enlarged form as it can create an obstruction to the foot.

(5) Soffit: The bottom surface of the stairs is known as the soffit. A soffit can be stepped or straight. It may be invisible due to the construction of the store or any other facility under the stairs.

(6) Waist slab: The waist slab is the slab provided in the stairs. The waist represents the minimum thickness perpendicular to the soffit and the stairs.

(7) Baluster: These are the vertical members on the railing. The balusters can be made of various aesthetically pleasing designs. These can be made of wood, concrete, steel, etc.

(8) Balustrade: The balustrade is also known as the railing or hand rail of the staircase. The railings are constructed using multiple balusters.

(9) Scotia: A wooden block provided under the nosing of the staircase is known as scotia. It imparts strength to the nosing.

(10) Handrails: Handrails are provided to support the user of the staircase. It is supported by balusters.

(11) Newel post: Newel post is the major vertical member that is constructed for anchoring the handrails. It is provided on the foot, top, and landing of the staircase.

(12) Landing: It is a horizontal leveled floor provided at the places where the staircase changes direction. It can be provided at the top, bottom, or at intermediate of the staircase.

(13) Headroom: It is the gap between the step and the obstruction at the top. It is also known as head clearance. The headroom should be sufficient to avoid injuries. A headroom of approximately 2 m is sufficient.

(14) Winder: When the staircase changes direction, the shape of the steps is modified for taking the turn. This is done by providing the steps with varying shapes known as winders.

TYPES OF STAIRCASES.

1. Straight Staircase:-

The straight staircase consists of steps in a straight line and there is no turn in such type of staircase. The straight staircase provides sufficient visibility to the users and reduces the chances of accidents due to its straightness. The landings are provided so that users can rest if there are a large number of steps. If the wall is not on the side of the straight staircase, the railings are provided.

2. Dog-legged Staircase/ Half-turn Staircase

The dog-legged staircase or half-turn staircase consists of two parallel flights connected to a common landing. This type of staircase is also known as a U-shaped staircase. The stairs turn at an angle of 180º. Normally, this type of staircase is constructed in multi-story buildings.

3 Open Well Staircase

The open well staircase is the same as the dog-legged staircase but the space provided between two flights is more as compared to the dog-legged staircase. The space between flights looks like a well and the steps are circled around this space.

4 Spiral Staircase

In the case of spiral staircase, the steps are curved and attached to a newel post. The central shaft is made of iron, steel or wood. The spiral staircase are stylish and aesthetically pleasing. This type of staircase can be customized according to the requirement and available space. The hand railing is provided. If the availability of space is limited, the spiral staircase is provided.

5 Quarter-turn and Three Quarter-turn

When there is a need of changing the direction of the stairs, the turns are provided at the 90º angle at different levels. In this case, quarter-turn, three-quarter-turn, and, half-turn staircases may be provided.

6 Bifurcated Staircase

In the case of a bifurcated staircase, the staircase is constructed in a single line but after some height, it is divided into two opposite directions. In this case, three flights meet at a common landing. The bifurcated staircase is helpful in channelization of the crowd.

2. Describe comprehensively all types of windows with their components, applications.

Ans:- A window may be defined as an opening in the wall that is made for the entry of natural light and fresh air into the building. A window also provides an outside view to the residents of the building..

The following points should be kept in mind before deciding the location and type of windows:

- The glass is used in the windows so that the light can enter even if the windows are closed.
- The windows should be provided at the parallel wall for cross ventilation of the air.
- The height of the sill of the window in the rooms is kept 60 cm to 90 cm above the floor. It helps the residents to get a view from the outside.
- The height of the windows in the bathroom is kept around 2 m above the floor.
- The grills are provided at the windows for safety purposes.
- The sun shade can be provided to prevent the entry of rainwater into the rooms.

TYPES OF WINDOWS

1 Full Paneled Window

The full paneled window is the oldest form of window which is still in use throughout the world. The full paneled window is made of wood. Currently, polyvinyl chloride (PVC), plywood, aluminium, etc. are also used for making the full paneled window. The number of panels in this type of window can be one, two, three, or six. Figure 4.12 shows the full paneled window. The full paneled window offers the following advantages:

- The strength of the full-paneled window is high. It is strong comparatively.
- It blocks the view of the outsider completely. So, it is safe from the point of view of security.
- The timber is easily available. The different types of timbers for making this type of window can be selected based on the budget of the user.
- The timber can be cut into any desired shape.

2. Glazed Window

In glazed window, glass is used in the panels. The glazed windows are widely used and provide the facility of sunlight entry even if it is closed. It is aesthetically appealing and widely used in the residential buildings, hotels and government buildings. The various types of glass like frosted glass, tinted glass, etc. are used in the glazed windows. The frame of the window can be made of aluminium or timber and glass panels are installed in the frame.

3 Partly Paneled Window

The partly paneled window is a hybrid form of the paneled and glazed window. The lower portion of the partly paneled window is made of timber while the upper part is made of glass. So, the light can enter the room from the top of the window. Privacy is maintained by the lower part of the window however the upper part gives the advantage of a glazed window.

4 Wooden Windows

The windows and their frames can be made of a number of materials. The majorly used material for making the windows are wood, steel, and aluminum. Every material has its own advantages

and limitations. As discussed in the previous section, wooden sections can be used for making the frames of the window and the panels of the windows too.

5 Steel Windows

Steel is a highly durable material for making windows. The steel is manufactured in controlled conditions in the factories. The steel windows have the following salient features:

- The strength of the steel is very high. It can support large glass panels.
- Due to its high strength, steel can be provided in thin frames. It maximizes the viewing capacity of the window.
- The weight of steel windows is high as compared to the wooden frames.

6 Aluminium Windows

Aluminium is widely used as a window material nowadays. Due to its lightweight and flexibility, it is a good alternative to wooden and steel frames. The aluminium windows have the following salient features:

- Aluminium is an economical material as it costs less than wood.
- The light weight of the aluminium frames is their most considerable advantage. Due to its lightweight, it can be transported and handled easily.

7 Sliding Windows

The sliding windows have the following salient features:

- A sliding window is very easy to operate. Senior citizens and physically handicapped people can use sliding windows as these require less force to open and close due to the roller-bearing mechanism.
- A sliding window is provided with high-quality glazing that makes it highly energy efficient.
- It can act as a barrier to sound and a good insulator of heat.
- Aluminium is used in sliding windows generally. The sliding window frames have the ability to hold large glass sections, which maximizes their viewing capacity.

8 Louvered Windows

The louvered windows have louvers or blades that can bead justed at any equal angle. When it is closed it gives an equal amount of air throughout the room and privacy is maintained. The blades in the louvered windows can be fixed or adjustable. In the case of fixed blades, these are

kept at an angle of 45º. The inclined blades help in draining the rainwater too. The louvered windows can be used in toilets, bathrooms, and factories.

9 Bay Window

A bay window is projected outside the building any angle. The bay window is a combination of windows that extends beyond the external wall in triangular, rectangular or polygon form.

10. Clerestory Window

Clerestory window is pronounced as clear story window. The clerestory window is provided near the ceiling. The major function of the clerestory window is to remove the contaminated air from the room. The window is pivoted both the sides and can be opened from the bottom. Clerestory window is a ventilator.

11. Corner Window

The corner window is a combination of two windows that are provided at the corner of the building and remains perpendicular to each other. This type of window can be provided in small or large sizes depending on the size of the structure.

12 Gable and Dormer Window

A gable window is provided at the triangular part of the sloping roof. It has a flat surface. The gable windows provide sufficient natural light to the room. The dormer windows are projected in nature and are provided at the sides of sloping roofs.

13 Skylight Window

A skylight window is a kind of ventilator that is provided parallel to the sloping roof. It is made by cutting the roof. The frame is installed in the cutting of the roof. The glass is provided in the skylight window for the passage of light to the room. The skylight window is used for the mills and factories. The skylight windows can be opened if required.

UNIT-5:- Building Finishes

2 MARKS QUESTIONS

1. What is floor finishing?

1. Floor finishing is the process of providing a smooth, durable, and attractive top surface to a floor.
2. It protects the structural base from wear, dust, and moisture.
3. Enhances appearance and comfort.
4. May include tiles, marble, or concrete finishes.
5. Final step in flooring construction.

---

2. List any four types of floor finishes.

1. Cement concrete flooring
2. Kota stone flooring
3. Marble flooring
4. Vitrified tile flooring
5. Wooden flooring

---

3. What is skirting?

1. Vertical strip provided along the junction of floor and wall.
2. Protects wall from water, dust, and damage.
3. Usually 75–150 mm high.
4. Made of tiles, marble, or cement mortar.
5. Gives neat floor–wall joint appearance.

---

4. Define dado.

1. Portion of wall surface above skirting and up to 1.2 m height finished with tiles or marble.

2. Protects wall from stains and splashes.
3. Common in kitchens and bathrooms.
4. Usually same material as flooring.
5. Improves appearance and hygiene.

---

5. What is vitrified tile flooring?

1. Flooring made using vitrified tiles (silica + clay + quartz + feldspar).
2. Tiles are polished and non-porous.
3. Highly durable, glossy, and stain-resistant.
4. Available in various colors and patterns.
5. Used in modern buildings.

---

6. Differentiate between marble and granite flooring.

Marble	Granite
Metamorphic rock	Igneous rock
Softer and more porous	Harder and denser
Needs regular polishing	Low maintenance
Available in light shades	Available in dark shades
Used in residential floors	Used in heavy-traffic areas

---

7. What is wooden flooring?

1. Flooring made from wooden planks or strips.
2. Provides warmth and aesthetic look.
3. Used in auditoriums and residential rooms.
4. Requires moisture-proof base.
5. Needs regular polishing.

---

8. List types of roofing materials.

1. Reinforced Cement Concrete (RCC)
2. Mangalore tiles
3. Asbestos cement (AC) sheets
4. Galvanized Iron (GI) sheets
5. Slate, timber, or aluminum sheets

---

9. What is a flat roof?

1. Roof with slope less than 10°.
2. Used in areas of low rainfall.
3. Can be used as terrace or balcony.
4. Common in RCC structures.
5. Requires proper waterproofing.

---

10. Define pitched roof.

1. Roof with slope greater than 10°.
2. Used in areas with heavy rainfall or snow.
3. Constructed with timber trusses and tiles/sheets.
4. Quick drainage of rainwater.

5 MARKS QUESTIONS

1. Explain vitrified tiles and chequered tiles flooring.

Ans:-

Vitrified tile flooring:

- Tiles made using silica + clay + feldspar under high temperature.
- Non-porous, glossy surface.
- Low water absorption (<0.05%).
- Laid on cement mortar or adhesive.
- Suitable for offices, malls, and residences.

Chequered tile flooring:

- Precast concrete tiles with raised patterns.
- Used in outdoor areas, verandahs, and footpaths.
- Skid-resistant and durable.
- Fixed with mortar over compacted base.

2. Explain marble flooring with their suitability.

Ans:-Marble stone is a type of metamorphic stone. When the composition of limestone is changed due to excessive pressure and temperature under the earth's surface, it is referred as a marble stone. Marble stones are widely used as a flooring material. Marble stones are white in color however blue, pink, yellow, and black shades may also exist due to the impurities present in the marble.

These stones consist of calcium carbonate and which is alkaline in nature. Marble flooring has the following features:

(1) Marble is a naturally available stone with a very high ability to get finished. It gives a smooth and elegant appearance.

(2) Due to its smooth surface, the marble flooring is easy to clean.

(3) Marble flooring offers a range of colors. However, the color of the purest form of the marble stone is white. As it is a naturally occurring stone, the shades for each tile may vary slightly.

(4) These types of flooring remain cool but also offer good heat conduction. So, these can be used in cold regions too. Radiant heat can be used for warming the tiles.

(5) Marble flooring is highly durable. The floor remains stain free if maintained properly.

(6) Marble flooring provides continuity and the number of joints is less in the case of marble flooring.

3. Differentiate between Ceramic Tiles and Vitrified Tiles.

Ans:-

(1) Ceramic tiles give a natural earthen appearance while vitrified tiles give an artificial glassy appearance.

(2) The texture of the ceramic tiles is rough as compared to the vitrified tiles. The vitrified tiles provide a smooth surface.

(3) The ceramic tiles are protected by the process of glazing while the vitrified tiles can be polished for providing a shiny surface.

(4) The flexural strength of ceramic tiles is lesser than vitrified tile. The flexural strength of the ceramic tiles is approximately 20 N/ mm2 while the vitrified tiles have a flexural strength of around 35 N/ mm2.

(5) Ceramic tiles are more porous in nature. Due to the high porosity of ceramic tiles, the frost resistance is lesser in these tiles as compared to the vitrified tiles.

(6) Ceramic tiles are more economical as compared to vitrified tiles.

(7) There is a requirement for skilled labor for the installation of ceramic tiles. These are more difficult to install as compared to the vitrified tiles.

(8) The breaking strength of the ceramic tiles varies from 700 N to 1000 N while the vitrified tiles have a breaking strength of more than 1100 N.

4. Explain the difference between AC sheets and GI sheets.

Ans:-

Asbestos Cement (AC) Sheet

(1) These sheets remain less hot in the summer season. So, it is easy to work under them.

(2) The AC sheets offer good resistance to fire.

(3) These sheets prevent the entry of water. These are completely waterproof.

(4) The AC sheets don't rust with time.

(5) These sheets require no paint.

(6) These sheets can get cracked. So, the AC sheets should be handled carefully during the laying process.

Galvanized Iron (GI) Sheet

(1) These sheets are light in weight. The GI sheets are lighter than asbestos cement sheets.

(2) These sheets are stronger than AC sheets. These sheets don't crack due to the collision during lifting and handling.

(3) These sheets remain hot during the summer season. So, it is difficult to work under them due to the high temperature.

(4) Rusting is a major problem in GI sheets. However, the zinc treatment reduces the rusting of these sheets.

(5) These sheets don't provide sufficient resistance to sound and heat.

5 Explain King Post Truss

Ans:- King post truss is created by the combination of triangular frames. A king post truss consists of the members like tie beams, rafters, struts, king posts, and ridge beams. The rafter and ties need support as these can get deformed under the impact of their self-weight.

So, additional rafters are provided to support the upper members in the middle of the truss. The king post truss can be used for shorter spans. The maximum span for the king post truss can't be more than 9 m. A vertical column is placed in the mid of the truss. This column is known as the king post.

The king post truss has the following features:

(1) The king post is used for short spans. It can be used for the construction of bridges too.

(2) These are used in the construction of timber roofs.

(3) The king post truss is cost-effective.

(4) Due to the number of structural members in the truss, the intermediate space can't be used.

(5) King post truss is not suitable for spans more than 9 m.

10 MARKS QUESTIONS

1. What do you understand by plastering? Write down its necessity. Explain briefly the procedures for the process of plastering.

Ans:- Plastering is a procedure in which a wet mixed material (cement/lime mortar) is used to cover the internal and external walls and rough patches on the surface of columns, beams, and other building parts. It provides even, clean and durable surfaces for easy and direct decoration. Plastering is done on buildings components for the following reasons:

- It protects the external surface of the building from environmental effects such as rain and wind.
- It provides a smooth and even surface in which dust or mud cannot stay on the wall.
- It provides a better surface for decoration.
- It helps in protecting building surfaces from bugs or insects.
- It covers the defects due to unskilled workmanship.
- It provides an excellent base for whitewashing, painting, or distempering.

PROCEDURE OF PLASTERING

The plastering is performed in various steps. The process of plastering is given as follows:

(1) Surface preparation: Before beginning the plastering, the surface is prepared for taking the coats of plaster. The surface is prepared as follows:

- All mortar joints have to be cleaned up to a depth of 10 mm in the brick mortar and 15 mm in the stone mortar for better plastering.
- Wire brushes are used to remove mortar dusting over the wall surface.
- Any path holes are filled and unevenness in the surface is leveled.
- The clean surface should be washed and kept wet before use for better suction.
- If any projection present on the wall surface is more than 12 mm, then it has to be
- removed for obtaining a uniform surface.
- If plastering is to be done on an old wall surface, all dust, paints, oil, grease, etc. should
- be removed.

(2) Groundwork before plastering: The groundwork before plastering is done as follows:

- To get plastering of uniform thickness, the wall surface is marked with dots. Dots refer to plastering a small patch of size 15 mm x 15 mm with a thickness of 10 mm.
- These dots are fixed horizontally and vertically at a distance of 2 m between them from center to center.
- Plumb bobs are used to check the vertical of dots.

(3) Base coat application: The base coat application is done in the following steps:

- The thickness of base coat plastering in brick masonry is kept around 12 mm and in concrete masonry, it is 9 mm.
- In bathe se coat, the ratio of cement to sand is 1:3 to 1:6
- Flat wooden floats are used to level the surface

(4) Finish coating application: The finish coating is applied in the following steps:

- The finishing coat thickness varies from 2 to 3 mm.
- The ratio of cement to sand is 1:4 to 1:6.
- Flat wooden floats and steel trowels are used for even surfaces and provide the finishing touch.
- Application is done from top to bottom and in one single operation so that no cracks can be developed.

(5) Curing after plastering: After finishing the coat, the water sprinkling is done for at least 7 days to gain proper strength and hardness. Plastering works is raped with jute gunny bags to kee wet for a longer duration. Proper curing work should be carried out otherwise crackin formation can occur.

2 .What is Pointing? Write down the necessity of pointing. Explain different types of Pointing

Ans:- The process of coating the joints with mortar is known as pointing. In pointing, the whole wall is not plastered but only the joints are coated with mortar. The wall need not to be painted in this case. So, it provides a natural appearance.

Necessity of Pointing

The joints in the wall are the weakest part. The water penetrates through the joints. So, the joints are sealed with the help of mortar in the case of pointing. The pointing increases the strength of the joints. It seals the joints and protect them from the impact of rainfall and sunlight. Pointing is

used for making the inferior masonry strong. For example, the mud masonry is weak. So, the joints can be protected by pointing in this case. To sustain the natural appearance of the wall, pointing can be used. In the case of plastering, the whole wall is covered while pointing maintains the natural beauty of the wall. The pointing work is more
durable than the plastering work as pointing cuts off the moisture. These work are also cost effective due to the minimal use of the mortar.

Types of Pointing

The pointing is provided in different types. The selection of pointing depends on the texture, location of the wall surface, aesthetics, and outlay. The different types of pointing are discussed as follows:

(1) Flush pointing: Flush pointing is the simplest form of pointing. In this type of pointing, the mortar is filled in the joint and flattened with the help of a trowel.

(2) U-grooved pointing: The jointers are used to make U-shaped grooves that are filled with mortar. This type of pointing looks good aesthetically.

(3) V-grooved pointing: The V-shaped grooves are made by jointers and filled with mortar. These pointings are used in the case of stone masonry.

(4) Keyed pointing: In keyed pointing, the semi-circular groove is filled with mortar. It is used in brick masonry generally.

(5) Raked pointing: In raked pointing, the square grooves are made for a stylish appearance.

(6) Weathered pointing: In this pointing, a slope is provided. This slope helps in draining the water rapidly from the joint.

(7) Mason-V pointing: Mason-V pointing is used in stone masonry. The mortar points out in this case.

(8) Bastard pointing: In the bastard pointing, a strip of 6 mm width is extended from the wall by 3 mm.

(9) Beaded pointing: In the beaded pointing, a semi-circular strip extends beyond the wall.

(10) Tuck pointing: In the tuck pointing a rectangular groove is made. This groove is filled with putty of different colors that make the pointing beautiful. Figure 5.16 shows the different types of pointings.

****