

## Internal Assessment Test – II

### BUILDING MATERIALS AND CONSTRUCTION(17CV36) SOLUTION

1.(i) Partly paneled and glazed door: These types of doors are widely used in all types of buildings since they are strong and give better appearance. Panel doors consist of vertical members called styles and horizontal members called rails. Styles and rails form the framework into which panels are inserted. Panels may be solid wood, plywood, particleboard or louvered or have glass inserts. Additional vertical members called mullions are used to divide the door into any number of panels. The minimum width of style is kept as 100 mm. The minimum width of bottom rail and lock rail is kept as 150mm. The entire frame is grooved on all the inside faces to receive the panels. Apart from panels glases are provided to admit light. The ratio of glazed to paneled portion is kept 2: 1.

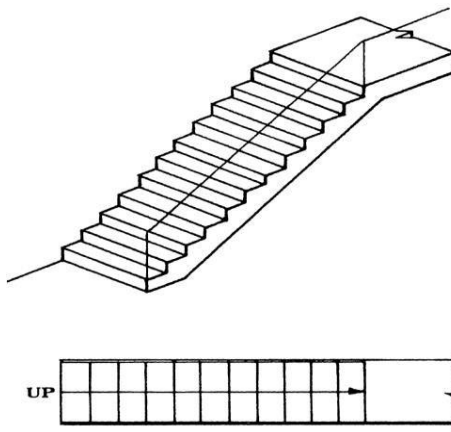
(ii) Revolving door: Such doors are provided in public buildings, libraries and museums. Provided entrance to one and exit to other person. The door closes automatically when not in use

Central vertical member has bearings at the top and bottom

(iii) Fully paneled door: These types of doors are widely used in all types of buildings since they are strong and give better appearance. Panel doors consist of vertical members called styles and horizontal members called rails. Styles and rails form the framework into which panels are inserted. Additional vertical members called mullions are used to divide the door into any number of panels. The minimum width of style is kept as 100 mm. The minimum width of bottom rail and lock rail is kept as 150mm. The entire frame is grooved on all the inside faces to receive the panels.

2.a. Classification of stairs:

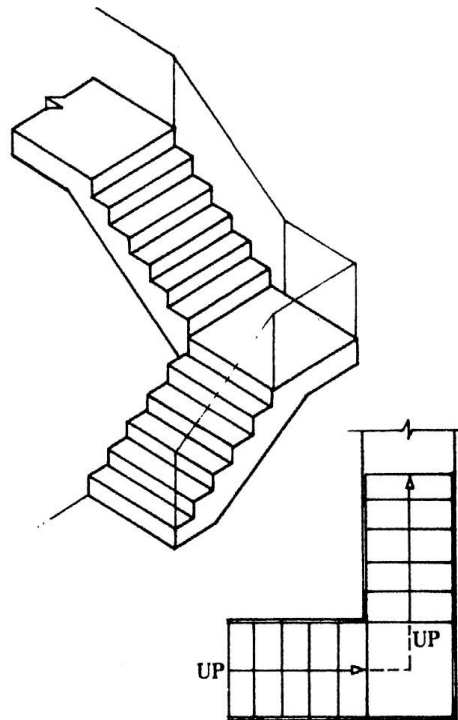
1.Straight stair



- All steps lead in one direction.
- Simplest form of stair arrangement.
- It may consist of one or more flights.
- They are used when space available for staircase is long but narrow in width.
- The width and the length of the landings should be equal.

## Turning stair

### i. Quarter turn stair



- A stair turning through one right angle is known as quarter turn stair.
- The change in direction can be affected by either introducing a landing or by providing winders
- If a quarter turn stair is branched into two flights at a landing is known as a *Bifurcated stair*.
- This types of stair is commonly used in the public buildings near the entrance hall .
- The stair has a wider flight at bottom which bifurcates into two narrower flights at the landing.

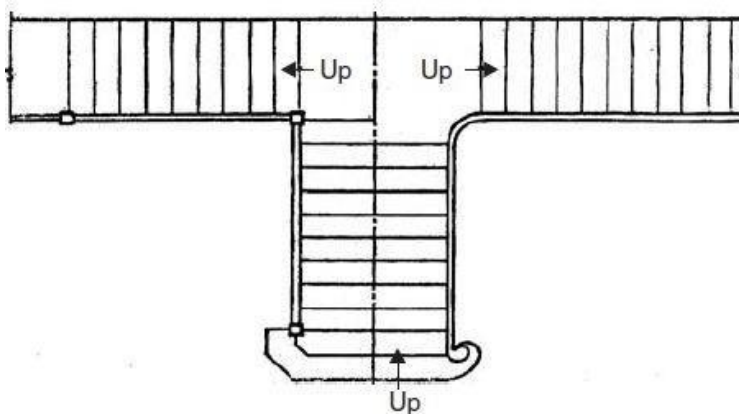
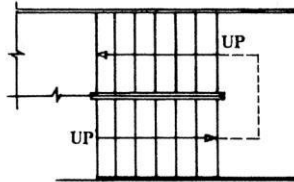
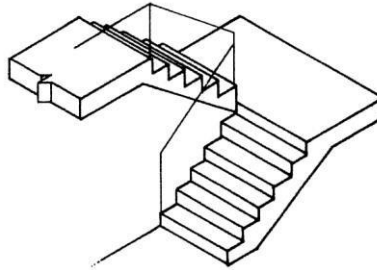


Fig. 8.40. Bifurcated stairs

### i. Half turn stair

- A stair turning through right angle is known as Half Turn Stairs.
- A half turn star may be of dog-legged type or open newel type.

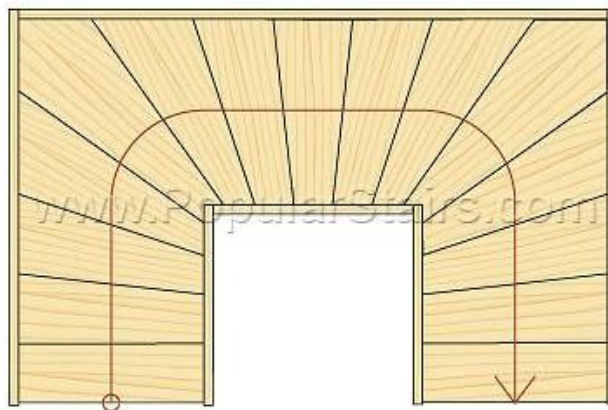
i. Dog legged stair



- The flights run in opposite directions and there is no space between them in plan.
- A level landing is placed across the two flights at the change of direction.
- This type of stair is useful where the width of the staircase hall is just sufficient to accommodate twice width of stair.

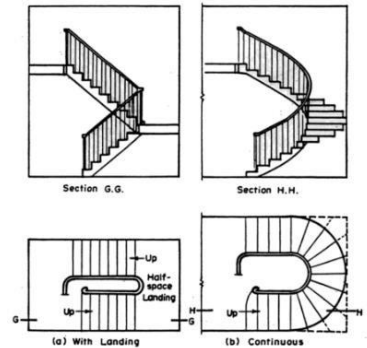
ii. Open well stair

- In case of open newel stair, there is a well or hole or opening between flights in plan.
- This well may be rectangular or of any geometrical shape and it can be used for fixing lift.
- These staircase are useful where available space for staircase has a width greater than twice the width of steps.



### iii. Geometrical Half turn stairs

- Have any geometrical shape and requires no newel posts.
- The handrail continues without interruption and without any angular turns.
- Its construction requires considerable skill and it is weaker than corresponding open newel stair.



#### 1. Three quarter turn stairs

- A stair turning through three right angles is known as a three quarter stair.
- In this case ,an open well is formed. This types of stair is used when the length of the staircase is limited and when the vertical distance between the two floor is quite large.

#### 2.b.

Stairs should be so located that it is easily accessible from the different rooms of a building.

- It should have adequate light and proper ventilation.
- It should have sufficient stair width to accommodate no. of persons in peak hour/emergency.

Generally for interior stairs, clear width may be

- ✓ at least 50cm in one/two family dwellings
- ✓ at least 90cm in hotels, motels, apartment and industrial building
- ✓ at least 1.1m for other types like hospitals, temples etc.
- No. of steps in a flight should be restricted to a maximum of 12, minimum of 3.
- Ample head room should be provided for tall people to give feeling of spaciousness. It should be minimum of 2.15m.

Ans  
(Q3)

Let the rise = 15 cm

tread = 25 cm

Width of each flight = 1.2 m

Width of landing = width of stairs  
= 1.2 m

No of risers required in each flight

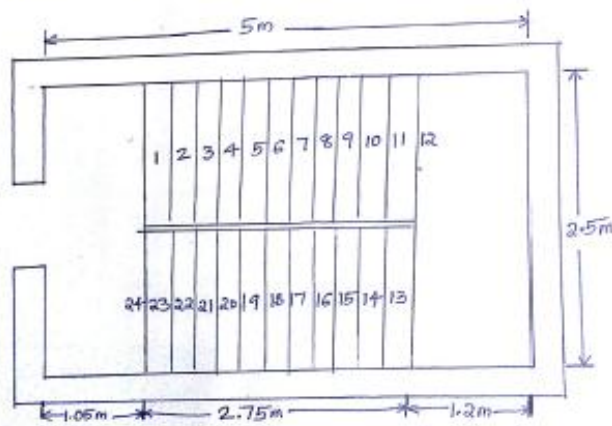
$$= \frac{360}{2 \times 15}$$

= 12 in each flight

No of treads = 12 - 1 = 11

Space occupied by treads =  $11 \times 25 = 275$  cm

Space left for passage =  $5 - 1.2 - 2.75$   
= 1.05 m



#### 4. Scaffolding, Shoring and Underpinning

• Shoring : It is the means of providing support to get stability of a structure temporarily under certain circumstances during construction, repair or alteration.  
Such circumstance arises when

1. The stability of a structure is endangered due to removal of a defective portion of the structure.
2. The stability of a structure is endangered due to unequal settlement during construction itself or in long run.
3. Certain alterations are to be done in present structure itself. Eg: remodeling of walls, changing position of windows etc.
4. Alterations are carried out in adjacent building for remodeling, strengthening of foundation, etc.

## Underpinning

- It is the method of supporting the structures while providing new foundations or carrying out repairs and alterations without disturbing the stability of existing structures. It is carried under following conditions:
  1. When a building with deep foundation is to be constructed adjoining a building which is built on shallow footings. Here the shallow footings should be strengthened first.
  2. In order to protect an existing structure from the danger of excessive or differential settlement of foundation.
  3. In order to improve the bearing capacity of foundation so as to sustain heavier loads for which deepening or widening of foundation is done.
  4. In order to provide a basement for an existing structure.

## Scaffolding

When the height of wall or column exceeds about 1.5m temporary structures are needed to support the platform over which workmen can sit and carry out constructions. These temporary structures constructed very close to wall in the form of timber or steel framework are called scaffolding.

### Components

- Standards: Vertical members of frame work supported on ground
- Ledgers : Horizontal members running parallel to wall.
- Braces: Diagonal members fixed on standards
- Putlogs: Transverse members placed right angles to wall
- Boarding: Horizontal platform to support workmen and material
- Guard rail: Rail provided at working level
- Toe board: Board placed parallel to ledgers and supported on putlogs to give protection at the level of working platforms.

### 5. Factors causing deterioration of stonework

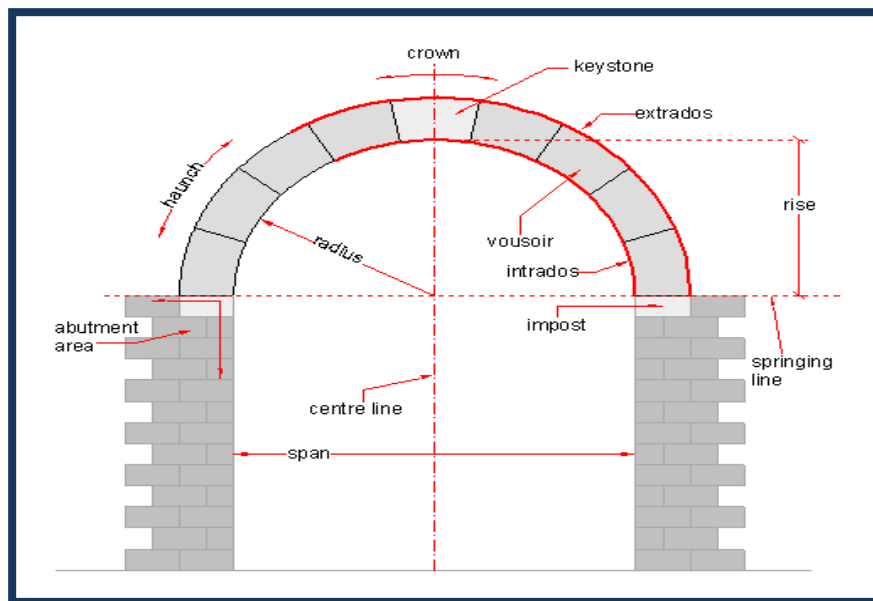
The stones with exposed faces are acted upon by various atmospheric agencies such as rain, heat, etc. and chemicals deteriorate the stones with time. Following are the causes of decay of stones:

1. Rain water - Rain water acts both physically and chemically on stones. The physical action is due to the alternate wetting and drying causes disintegration and the chemical action due to the rain water descends through atmosphere absorbs  $\text{CO}_2$ ,  $\text{H}_2\text{S}$  and other gases present in the atmosphere and affect the stones.
2. Wind – It carries fine particles of dust , when it blows at high speed particles will strike against the stone surface and thus stone will decayed. The wind allows rain water to enter pores of stones with force. Such water on freezing, expands and splits the stones.

3. Vegetable growth – The creepers and certain trees develop on the stone surfaces with their roots penetrating in stones joints. Such roots attract moisture and keep the surface damp. At the same time, they may try to expand also, resulting in stone decay.
4. Alternate wetness and drying – Stones are made wet by various agencies such as rain, frost, dew etc. It is found that stones subjected to such alternate wetness and drying wear out quickly.
5. Living organisms – Some living organisms like worms and bacteria act upon stones and deteriorate them.
6. Nature of mortar – The nature of mortar used as a binding material may react chemically with any one of the constituents of stones and thus lead to disintegration of stones.

#### 6. Requirements of good building stones:

1. Appearance- face work it should have fine, compact texture; light-coloured stone is preferred as dark colours are likely to fade out in due course of time.
  2. Structure - It should have a uniform texture, free from cavities, cracks and patches.
  3. Strength – It should be strong enough to withstand the disintegrating action of weather.
  4. Seasoning – stones should be well seasoned.
  5. Weathering – Resistance of the stones against wear and tear due to atmospheric agencies should be high.
  6. Specific gravity – It should be between 2.3 to 2.5.
  7. Toughness - Tough stones are used where vibratory loads are expected.
  8. Hardness - It is an important for floors, pavements and aprons of bridges.
  9. Porosity and water absorption – Porosity of the stone depends on mineral constituents, cooling time and structural formation. A porous stone disintegrates as it absorbs rain water, freezes, expands and causes cracking.
  10. Workability – Stones should be such that cutting, dressing and bringing it to shape and size should not be uneconomical.
7. Components of a segmental arch



- 1) Abutment:-This is the end support of an arch.

- 2) Intrados :-This is the inner curve or surface of an arch.
- 3) Extrados :-This is the outer curve or surface of the arch.
- 4) Voussoirs :-The voussoirs or arch stones are the wedge shaped units forming the arch.
- 5) Springing line:-This is an imaginary line joining the two springing points.
- 6) Crown:-This is the highest point of extrados or it is the highest part of an arch.
- 7) Keystone:-This is the highest central wedge shaped block of an arch.
- 8) Skew back: - Inclined surface of the abutment on which the arch rests.
- 10)Span:-This is the clear horizontal distance between the two supports.
- 11)Rise:-this is the vertical distance between the highest point on the intrados and the springing line.
- 12) Depth of arch:-This is the perpendicular distance between the intrados and extrados.
- 13) Haunch of an arch:-This is the portion of arch situated centrally between the key and skew backs.
- 14) Spandril:-This is the triangular walling enclosed by the extrados of the arch, a horizontal line through the crown of the arch
- 15) Soffit – Inner surface of an arch
- 16) Springing points – Points from which the curve of an arch springs
- 17)Centre – Geometrical centre of the curve of an arch
- 18) Ring – Circular course forming an arch
- 19) Arcade – Row of arches supporting a wall above and being supported by the piers.

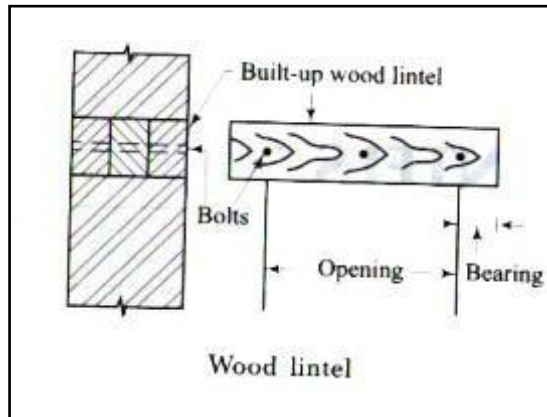
## 8.

A lintel is defined as a horizontal structural member which is placed across the opening.

Lintels are classified into the following types, according to the materials of their construction:

- Timber lintels
- Stone lintels
- Brick lintels
- Steel lintels
- Reinforced cement concrete lintels
- Timber lintels





- Easily available in hilly area.
- Oldest type of lintel
- Relatively costly, structurally weak and vulnerable to fire.
- Easily decay, if not properly taken care.

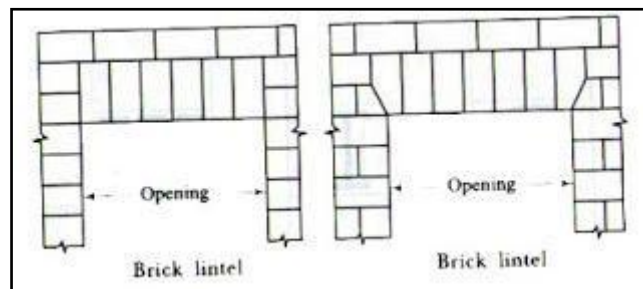
#### Stone lintels

- Used , where stones are easily available.
- Consists of a simple stone slab of greater thickness.
- The depth of stone lintel is kept equal to 10cm per metre of span , with minimum of 15cm.
- They are used for 2m span.
- It cracks when subjected to vibratory loads. So it should be used with caution where shock waves are quite common.



### Brick lintels

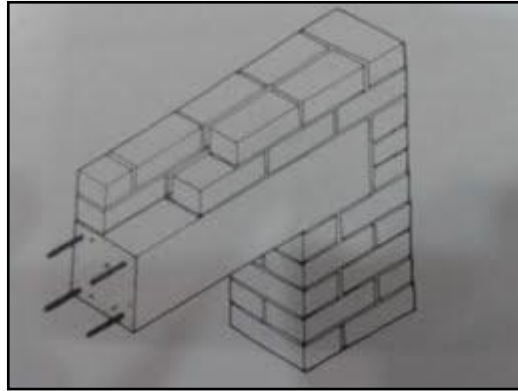
- The bricks are hard, well burnt and first class bricks .
- Suitable for small span.
- The bricks having frogs are more suitable, because when filled with mortar it increases the shear resistance of end joints.
- Depth of lintel is kept equal to 10 – 20cm depending upon the span



### Reinforced cement concrete lintels

- ❖ They may be pre-cast.
- ❖ For smaller span, the pre-cast concrete lintels are used.
- ❖ For cast in situ units , form work is required.
- ❖ Depth of lintel depends on span.
- ❖ Fire resistant
- ❖ Ease in construction

- ❖ Depth of lintel and reinforcement depends upon the span and the magnitude of loading
- ❖ Longitudinal reinforcements consists of mild steel bars are provided near the bottom of lintel to take up tensile stresses.



#### Steel lintels

- ❖ Provided at large opening and where the super-imposed loads are heavy.
- ❖ It consists of rolled steel joists.

