WINTER– 18 EXAMINATION

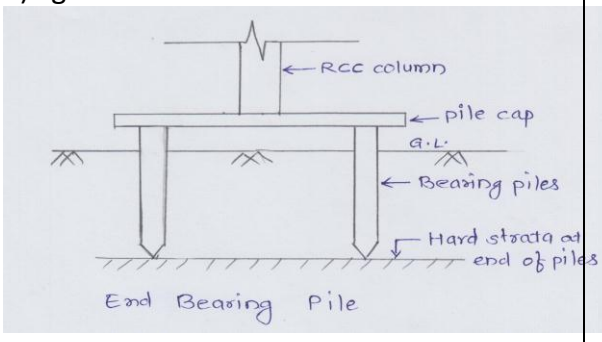
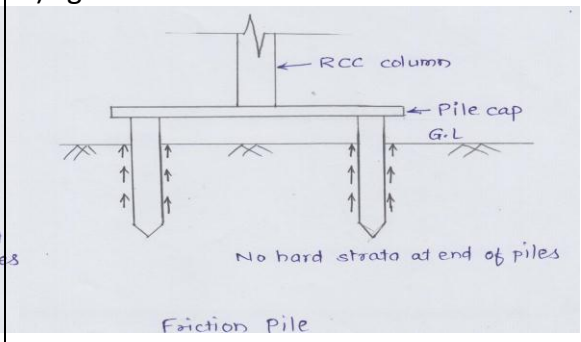
Subject Name: BUILDING CONSTRUCTION **Model Answer** Subject Code: 22304

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answers	Marking Scheme
Q.1		***Attempt any Five:***	***(10)***
	a)	***Define the terms substructure and superstructure used in building construction.***	
	Ans	**Substructure: -** A part of structure lying below the ground surface is known as substructure. **Superstructure: -** A part of structure lying above the ground surface is called superstructure.	01 M for each
Q.1	b)	***State any two functions of foundation of a building.***	
	Ans	The functions of foundation are- 1) To transfer the load of the structure up to the hard strata. 2) To distribute load of the entire structure over a wide spread area. 3) To increase the stability of the structure. 4) To prevent the lateral movement of supporting material To attain a level and firm bed for building operations.	Any two 01 M for each
Q.1	c)	***Enlist any four types of bonds used in stone masonry.***	
	Ans	**There are types of stone masonry as – Rubble, Ashlar, Coursed, Uncoursed, Random rubble, dry etc. Bonds are used in brick masonry as mentioned below.** **Types of bond:-** 1) Stretcher bond 2) Header bond 3) English bond 4) Flemish bond **@@ NOTE: Marks should be given to both answers related to stone & brick masonry.**	1/2 M for each
Q.1	d)	***Define the term 'Landing* and Pitch' used in stair.**	
	Ans	**Landing: -** It is flat platform at the top or bottom of a flight between the floors. **Pitch: -** It is the angle which the line of nosing of the stair makes with floor.	01 M for each
Q.1	e)	***Enlist any four types of floor finishes.***	
	Ans	**Four types of floor finishes:-** 1)Shahabad flooring 2) Kota flooring 3) Marble flooring 4) Granite flooring 5)Kadappa 6) Mosaic tiles 7) Pavement blocks 8)Tiled flooring 9) Tremix floor 10)Vitrified tiles 11) IPS 12) Ceramic	Any four 1/2 M for each
Q.1	f)	***State two necessities of Demolition.***	
	Ans	Demolition of building should be done due to following reasons:	Any two

		1) When the building structure is very old and not desirable to take the load any more then it is very essential to demolish the existing structure. 2) If any part of building is become very weak & unsafe. ***3)*** If any internal alteration or change is to be done.	01 M for each
Q.1	g) Ans	***Define 'Formwork' in building construction.*** **Formwork:-** The temporary casing provided to support concrete is known as formwork.	02 M
Q.2	a) Ans	***Attempt any Three:*** ***Classify the building as mentioned in National building code (2016) with examples of each.*** 1)Residential building:- e.g. lodging or boarding houses, hostel, apartment houses, flats 2)Education building:-e.g. school, college, board, university, library and research institution 3)Institutional building:-e.g. hospitals, stared hotels, clubs 4)Assembly building:-e.g. cinema hall, theatres, auditorium, museum, exhibition hall 5)Business building:- e.g. shop, store, offices, bank, establishment 6)Mercantile building:- e.g. shopping centre, departmental store, market building 7)Industrial building:- e.g. assembly plants, refineries, gas plants, mills diaries and factories 8)Storage building:- e.g. ware house, cold storage freight depot, transit shed, public garage 9) Hazardous building:- e.g. it used for storage, handling, manufacturing or processing of combustible or explosive materials or products.	***(12)*** Any eight 1/2 M for each
Q.2	b) Ans	***Differentiate between 'End bearing Pile' and 'Friction Pile'.***	Any four 01 M for each

End bearing pile	Friction pile
1) When piles transfer load of the building through a soft soil strata to a suitable bearing stratum at greater depths then it is called a bearing pile.	1) When piles transfer the loads only by means of skin resistance without any end bearing then the piles are called as friction piles.
2) The load is taken by the hard strata.	2) Load is taken by the friction developed between side of the pile and surrounding ground.
3)Hard strata is essentially required	3)Hard strata is not essentially required
4)It is used to transfer load through water or soft soil	4)It is used to transfer loads through a depth of friction
5)Fig: 	5)Fig: 

Q.2	c) Ans	***Describe any four forms of 'Rubble Masonry' with sketches.*** **1) Dry rubble masonry: -** In dry rubble masonry, dressed or undressed stones are used without mortar. Bigger pieces of stones are arranged at the bottom and smaller pieces of stones are used at the top. These walls are generally broader at the bottom and thinner at the top.	

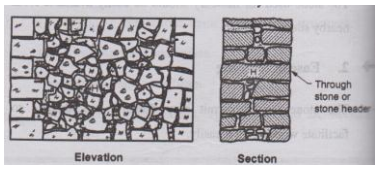
These types of masonry is used for the construction of retaining wall, boundary walls of a building.

2) Uncoursed rubble masonry: - In uncoursed rubble masonry, stones or rubbles are used without any dressing. The mason select the stones at random from heap and lays them in line and plumb so as to form a strong bond.

These types of stone masonry is useful for compound wall of jail, plinth wall, retaining wall etc.

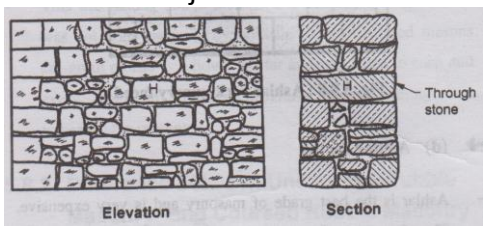
Any four

01 M for each



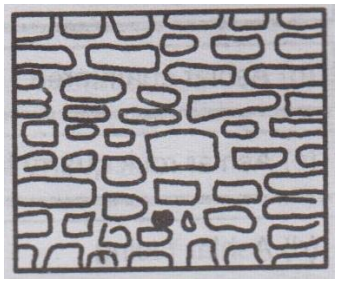
3) Coursed rubble masonry: - In this type of masonry, stones are placed to level course. Size of stones used are in between 50mm to 200mm. Joints are about 15mm in thickness.

C.R. masonry is commonly used in the building construction work where the wall height is low. Care must be taken that the joints must break in different courses.

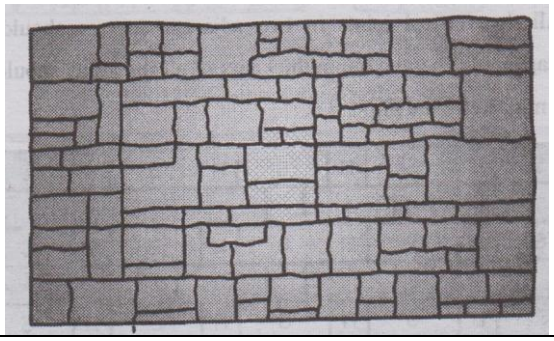


4) Squared rubble masonry (uncoursed): - Squared stone means whose edges have been made roughly straight. The stones are roughly dressed and are laid at random on their natural beds so that they are interlocked. The joints should not exceed 13 mm thickness. The gaps are filled by mortar and stone chips.

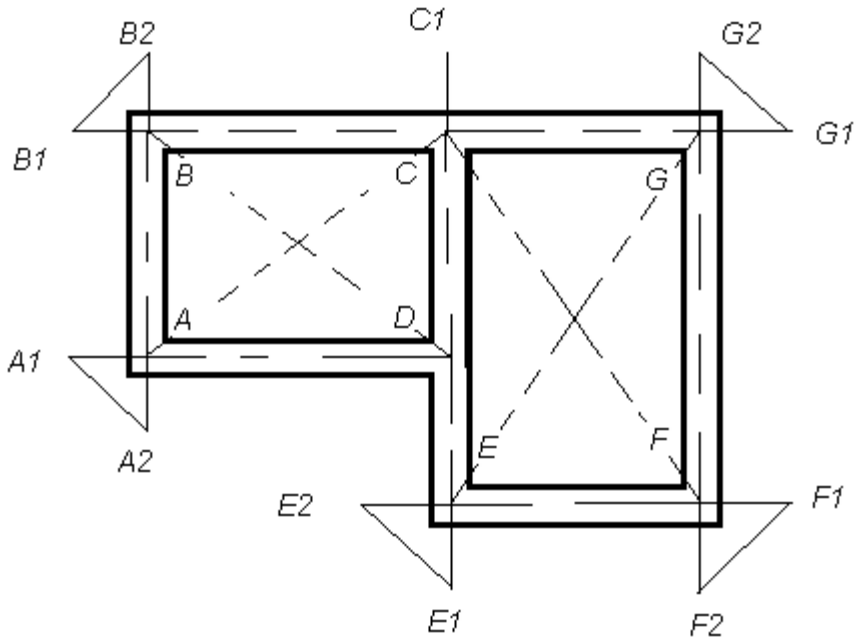
These type of masonry is used for making residential buildings, public buildings, boundary walls etc.

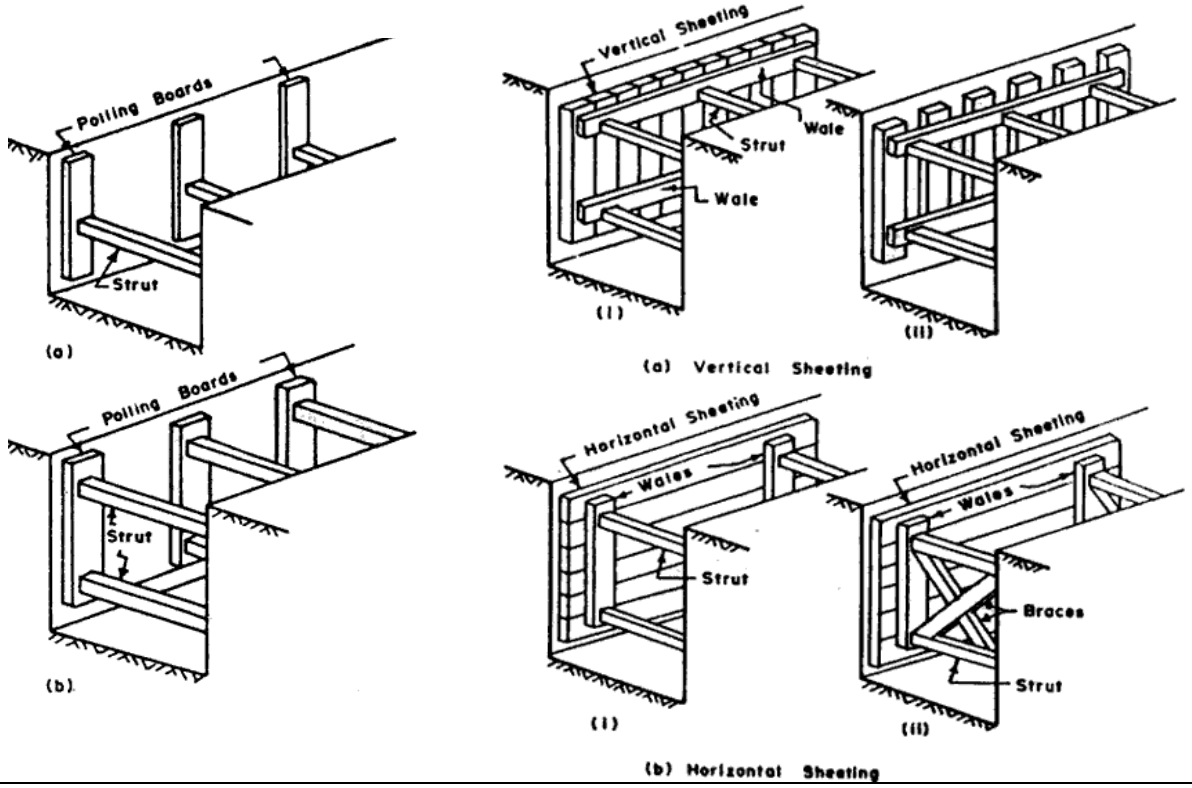


5) Squared rubble masonry (coursed): - In this type of masonry, semi-dressed stones are used. The stones are arranged in regular courses. Stones of equal height should be used in a course or two to three stones are kept above each other to make up the height of course. Mortar joint should not exceed 13 mm. the stone used in this masonry should be of uniform

		color. 	
Q.2	d) Ans	***Discuss the provisions of doors in a structure with reference to the location and purpose.*** 1) Doors should be located in opposite walls facing each other. 2) Doors should be located near the corner of room nearly 20 cm away from the corner. 3) To achieve optimum utilization of room, the number of doors in a room should be kept minimum. 4) The location and size of the door should meet the functional requirements of the room.	01 M for each
Q.3	a) Ans	***Attempt any Three:*** ***Explain the necessity of 'Scaffolding and Shoring'.*** **Necessity of scaffolding:** 1. To provide a working platform so that the worker can stand on the platform and do the work easily & safely 2. To provide a platform for placing material & logistics(tools & equipments) needed by the workers to carry out their job 3. Scaffolding support the platform that is used by the worker as their walking path to transport the material & logistics. 4. To reach the construction point as it progresses 5. Scaffolding is also needed for the repair or even demolition of building. **Necessity of shoring:** To provide temporary support to structures: that are in an unsafe condition until such time as they have been made stable, or which might become unstable by reason of work carried out on or near them	***(12)*** 02 M 02 M
Q.3	b) Ans	***Suggest suitable type of window for the following:*** ***i. Cinema Hall ii. Residential House iii. Staircase iv. Library of Hostel*** 1) Cinema hall – Fixed window 2) Residential bungalow – Panelled window / Casement windows / Sliding window 3) Enclosed R.C.C. staircase – Fixed window / Metal window 4) Library of Hostel – Glazed Window / Sliding window	01 M each
Q.3	c) Ans	***Explain the causes of non – structural cracks in building construction and remedial measures.*** **The important causes responsible for cracks in building are :** 1. Due to movement of ground. 2. Due to temperature variation. 3. Due to moisture changes. 4. Due to effect of chemical reaction. 5. Due to creep and elastic deformation. 6. Due to vegetation. **1. Due to movement of ground:** a) If the building is erected on or near an area which is likely to be subjected to mining	Any four causes 1/2 M for each

		substance landslides, earthquake etc. the movement of ground due to this factors can cause cracks in building. b) Building constructed on shrinkable soils are liable to crack due to volumetric change in subsoil conditions due to change in moisture content, unless special measures are taken. **2. Due to temperature variation:** a) In some materials the changes in temperature can cause appreciable change in their size the extent of movement due to temperature variation in the building components depends upon number of factors such as dimension of materials, its coefficient of expansion. b) In case of roof slab supported on load bearing walls, cracks occur due to temperature variation. The roof slab being exposed to the heat of sun, is subjected to alternate expansion and contraction. This movement of slab may result in pushing out top course of masonry and developing horizontal cracks in supporting walls. **3. Due to moisture change:** a) Most of the building materials like bricks, concrete, mortar, stones, timber etc. have pores hence these materials increases in size or expand on absorbing moisture and decrease in size or shrink on drying. b) Shrinkage on account of drying out of moisture contents in building material is one of the main factor responsible for cracks in the building. **4. Due to effect of chemical reaction:** a) The carbon dioxide present in the air reacts chemically with cement based product, resulting in increase in volume which ultimately leads to cracking. b) Soluble sulphates which may be present in the soil, ground water or clay bricks react chemically with Portland cement in presence of water and cause the concrete or mortar joint or brick itself to expand considerably leading to the formation of cracks. **5. Due to creep and elastic deformation:** a) The different components of building like wall, column, beam etc. undergo elastic deformation when loaded. b) The situation where cracking due to elastic deformation and creep arise are summarized as a cracks in masonry when a wall is unevenly loaded, cracks in masonry due to deflection of RCC beam or slab , cracks at a function of brick masonry with RCC column in load bearing walls. **6. Due to vegetation :** a) The effect of existence of vegetation near the building becomes more damaging when the soil at site is of shrinkable type. b) The roots of growing trees causes drying and shrinkage of the subsoil and this can result in unequal settlement of the foundation leading to cracks. **Measure adopted to prevent the cracks:** 1. Building should be well designed. 2. Proper curing should be done. 3. Continuous vertical joint in wall should be avoided by proper band. 4. Use of low quality material should be avoided. 5. There should be good workmanship. 6. Uneven settlement of foundation should be avoided by resting foundation on hard strata.	Any four remedies 1/2 M for each
Q.3	d) Ans	***Describe the procedure for layout of load bearing structure by center – line method.*** 1. From the plan (fig 1), the center line of the walls are calculated. Then the center lines of the rooms are set out by setting perpendiculars in the ratio 3:4:5. Suppose the corner points are A, B, C, D, E, F and G which are marked by pegs with nails on top.	

		2. The setting of the corner point is checked according to diagonals AC, BD, CF and EG.  Fig.1: Example plan to be set out on the ground 3. During excavation, the center points A, B, C, D, E, F, G may be removed. Therefore the center lines are extended and the center points are marked about 2m away from the outer edge of excavation. Thus the points A1, A2, B1, B2 and likewise, are marked outside the trench. Centre line are shown clearly by stretching thread or rope. The center points fixed 2m away from the excavation are marked with sit out pegs. 4. From the plan details, the width of excavation to be done is also marked by thread with pegs at appropriate positions. 5. The excavation width is then marked by lime or by with furrow with spade. 6. A theodolite should be used for accurate center line marking.	04 M
Q.4		***Attempt any Three:***	***(12)***
	a) Ans	***Explain timbering and strutting with a neat sketch.*** A method of giving the temporary support to the side of deep trench or when subsoil is loose or very soft is known as timbering (i.e. shoring) and strutting. It consists of timber planks and strut to give temporary support to the side of trench. When the depth of trench is large, or when the sub-soil is loose, the sides of the trench may cave in. The problem can be solved by adopting a suitable method of timbering. Timbering of trenches, sometimes also known as shoring consists of providing timber planks or boards and struts to give temporary support to the sides of the trench. Timbering of deep trenches can be done with the help of the following methods: **1.** Stay bracing. **2.** Box sheeting **3.** Vertical sheeting **4.** Runner system **5.** Sheet piling	02 M

			02 M (any one)
Q.4	b) Ans	***Explain the requirement of good formwork.*** **Requirements of good formwork** 1. It should be strong enough to resist the pressure or the weight of the fresh concrete and the superimposed loads due to equipment, men etc., if any. This requires careful design of the formwork, because the consideration of overloads will affect the economy whereas of under loads may cause failure of the formwork. 2. It should be rigid enough to retain the shape without undue deformation. Therefore, it should be so designed that deflection does not exceed 1/900th of span in normal cases. 3. It must be made or constructed as tight so that it does not allow the cement paste to leak through the joints. 4. The space enclosed by the form should be true to the size as designed. The form should, therefore, not warp, bend, bulge or sink to meet this requirement. 5. The inside surface of formwork should be smooth so as to give good appearance to the resulting concrete surface. To achieve this, the inside surface of formwork is usually applied with crude oil or soft soap solution. This also facilitates the removal of formwork. 6. The entire formwork should be so made that it can be removed easily without causing the least injury to the surface or edges of the concrete. 7. As the formwork does not contribute anything to the stability of the finished structure, it should, therefore, be made economical by reducing the cost through proper design, construction and use of proper material. 8. It should be as light as possible. So that it is easy to transfer. 9. The material of the formwork should be cheap, easily available and should be suitable for reuse. 10. Self-weight of the form work should be less. 11. It should be easily possible to give the required geometrical shape to the form.	Any four 1/2 M for each
Q.4	c) Ans	***Enlist and draw various fixtures and fastenings for doors and windows.*** **Types of Fixtures and Fastenings for Doors and Windows**	

Hinges

Hinge is fixture which helps the door to rotate freely along its axis. There are so many types of hinges are there which are as follows.

1. **Butt Hinge**
2. **Back Flap Hinge**
3. **Counter Flap Hinge**
4. **Parliamentary Hinge**
5. **Spring Hinge**
6. **Rising Butt Hinge**
7. **Garnet Hinge**
8. **Nar-Madi Hinge**

Any four

01 M for each.

Bolts

Doors or windows bolts are used to provide security for the rooms. Different types of bolts are described below

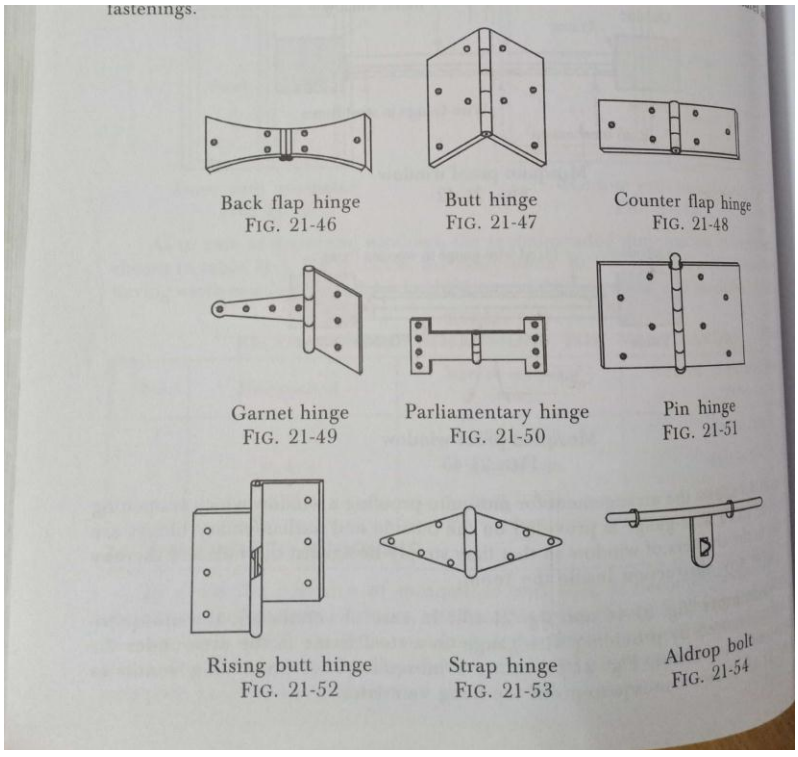
1. **Hook and Eve Type Bolts**
2. **Flush Bolt**
3. **Aldrop Bolt**
4. **Barrel Bolt**
5. **Espagnalette Bolt**
6. **Hasp and Staple Bolt**

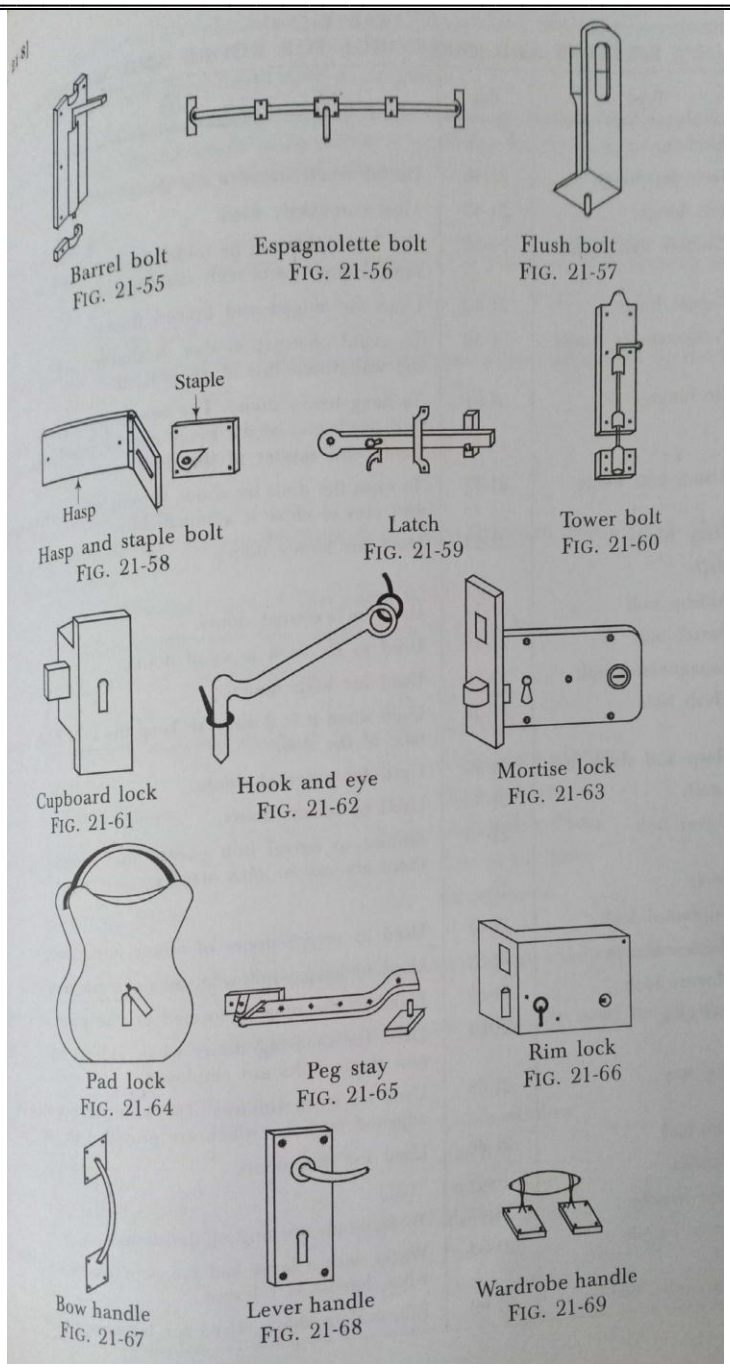
Handles

Handles are used to open or close the door or windows. There are many types of handles are available. Some of them are Bow type, Lever handle, Door handle, Wardrobe handle etc

Locks

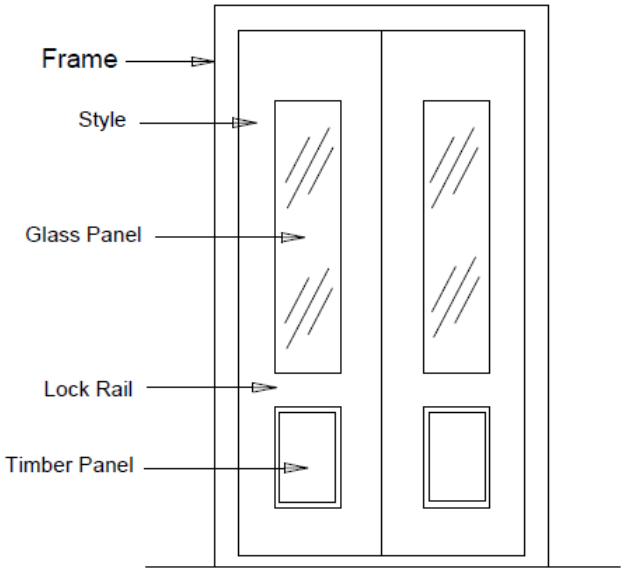
Locks used for doors and windows are many types and some of them are padlock, mortise lock, rim lock, cupboard lock and lever handle lock etc.





Q.4	d) Ans.	***Suggest the roofing material for various types of pitched roofs with justification.*** Roof covering is an essential component of pitched roof to be placed over the framework **Types of roof covering** • **Thatch covering:** It is a very old roofing method and has been used in both tropical and temperate climates. People who desire a rustic look for their home, would like a more ecologically friendly roof. • **Wood shingle roofing:** Used in hilly areas • **Tile roofing:** Used for residential buildings and country houses	Any four 1 M for each

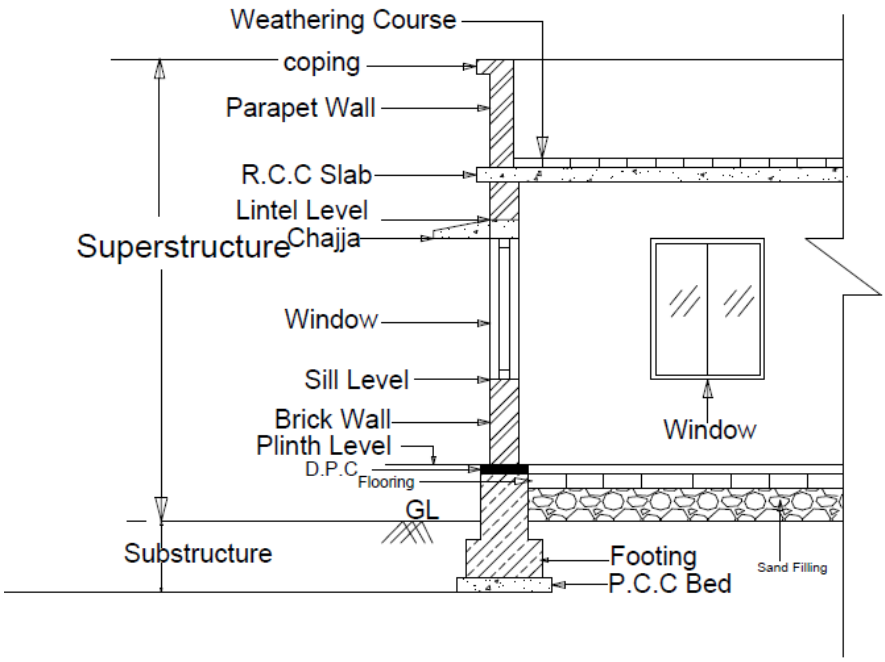
		• **Asbestos cement sheet roofing:** Used for industrial buildings, factories, sheds, cinema houses, auditorium, residential buildings • **Galvanised corrugated iron sheet roofing:** Not used for slopes flatter than 1 in 4 • **Eternit or slate roofing:** slate roof pitches as low as 15°. • Light weight roofing: Used for wide span industrial structures	
Q.4	e) Ans.	***Describe the procedure for carrying out the 'Plastering' in cement mortar in two coats.*** • The mix ratio of mortar in case of cement plastering depends upon the nature of the work to be plastered. • For rich plastering work at sensitive places (e.g. in side bathrooms, W.C. etc.), 1:3 cement plaster mix is used. For general plastering of walls 1:5 to 1:8 cement plaster mixes are used. **<u>Preparing the surface</u>** • Before applying the plaster, the surface should be prepared properly. • The joint of masonry are properly raked to a depth of 20 mm to provide key to plaster. • The surface is then thoroughly wetted with water, washed well and kept wet for six hours. • When the surface is ready, plaster is applied. **<u>Applying the plaster</u>** • Cement plastering may be applied in one or two coats. • In case plastering is to be done in two coats the first coat is applied as described below. • The mortar is dashed against the prepared surface into a uniform thickness with the help of trowel. • Wooden screeds 7.5 cm wide and of required thickness of the plasters are generally fixed vertically 2.4 to 3 m apart to act as gauges/ guides in order to keep the plaster to the required thickness. Careful plumb line should be done in fixing of these screeds. • Surplus mortar is removed with the help of mason's straight edge and then the mortar is pressed well with a wooden float so that mortar may fill in the joints of the masonry. • The thickness of this coat should not be more than 16 mm. • Before applying the second coat, the first coat is allowed to set but it should not become dry and it is also roughened with a scratching tool to provide key to the second coat. • The second coat is then applied in a thin layer not exceeding 3 mm in thickness within 48 hours. It is then well trowelled and rubbed perfectly smooth with the help of a steel float. It is then allowed to set for 2 days and cured for more than 7 days.	01 M 01 M 02 M
Q.5	a) Ans.	***Attempt any Two:*** ***Draw labeled sketch of partly paneled and partly glazed door with door frame for a opening size of 1200 mm x 2200 mm.***	***(12)***

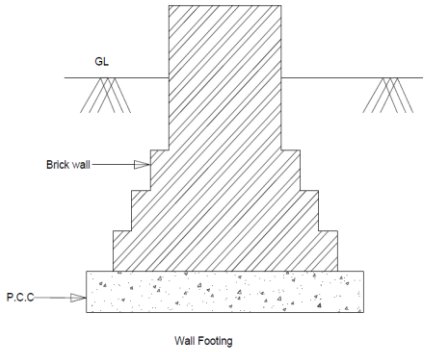
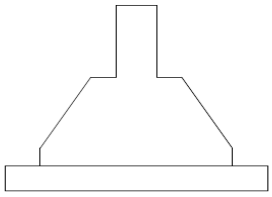
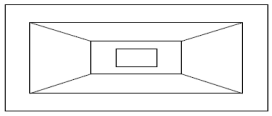
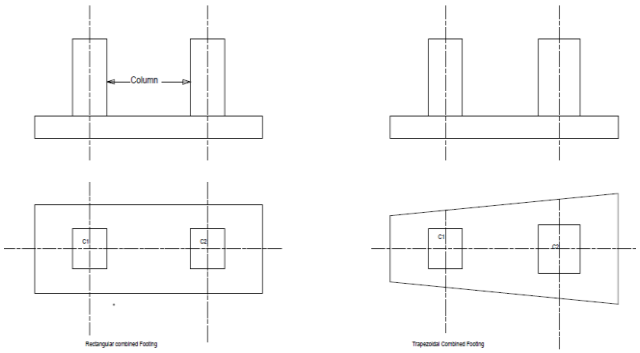
		 Partly Panelled and Partly Glazed Door	04 M for fig. 02 M for labeling
Q.5	b) Ans .	***Define settlement of foundation and its types. Enlist various causes and suggest remedial measures for the same.*** **Settlement of foundation**: Due to the self-weight and the live load of the structure and due to compressibility of the soil supporting the foundation of the structure, settlement of the structure does occur. Settlement is the vertical downward movement to the loaded base. As a result of settlement, the original depth of soil mass decrease due to soil grains coming closer together. Uneven settlement leads to cracks. The amount of settlement is different for different type of soil or rock. For example there is no or very less settlement for rocky strata whereas settlement is very large in case if marshy land. Settlement is time dependent process i.e in case of clayey soil settlement is very gradual, continuous for long time and is more. On the other hand for sandy soil settlement is quick and less. Types of Settlement: 1**. Differential foundation settlement**: Settlement that occurs at differing rates between different portions of a building is termed differential settlement. Differential settlement occurs if there is difference in soils, loads, or structural systems between parts of a building. In this case, different parts of the building structure could settle by substantially different amounts. 2**. Uniform foundation settlement**: When foundation settlement occurs at nearly the same rate throughout all portions of a building, it is called uniform settlement. If all parts of a building rest on the same kind of soil, then uniform settlement the most probable type to take place. However, it influences utility of the building for example damaging sewer; water supply; and mains and jamming doors and windows. **Causes of settlement are** : 1. Uneven bearing capacity of soil at foundation level. 2. Different loads on different parts of foundation. 3. Varying ground water table height. 4. Compressible foundation soil.	01 M 01 M 02 M

		5. Earthquakes and floods. 6. Expansive soil such as black cotton soil. **Various remedial measures**: 1. Compaction of soil over the complete area at foundation level. 2. Proper designs so that large load difference does not exist on different parts of the foundation. 3. Dewatering of foundation if ground water table interference with construction of foundation. 4. Stabilization of soil of foundation level if it is compressible. 5. Special type of foundation for expansive soils such as black cotton soil. 6. Consideration of earthquake loads and other earthquake resisting methods during design and construction of buildings.	02 M
Q.5	c) Ans.	***Compare stone masonry construction with brick masonry construction.***	Any six 1 Mark For each

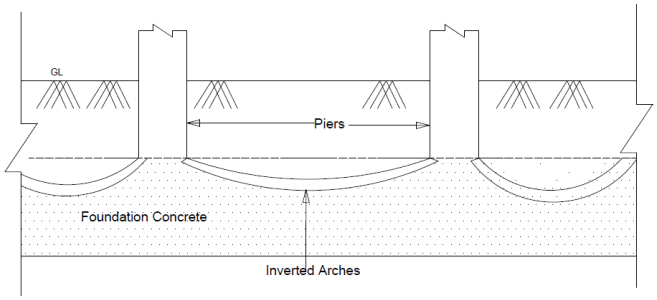
STONE MASONRY	BRICK MASONRY
1. Stone masonry is stronger and more durable than brick masonry	1. Brick masonry is less stronger and less durable than stone masonry.
2. Dead load & thickness of wall is more in stone masonry construction .	2. Dead load & thickness of wall is less as compared to stone masonry construction .
3. It is costly than brick masonry .	3. It is cheaper than stone masonry and can be easily constructed
4. Being non-uniform and irregular in shape, proper bond cannot be easily obtained in stone masonry.	4. Being uniform and regular in shape, proper bond can be easily obtained in case of brick masonry.
5. It is possible to develop better architectural effects by stonework.	5. It is not possible to develop better architectural effects by brickwork.
6. The stone masonry construction proceeds vary slowly.	6. The brick masonry construction proceeds very quickly.
7. It is not essential to plaster the stone masonry walls, when exposed to the open atmosphere.	7. Brick walls have to be plastered or painted, when exposed to the open atmosphere.
8. Stones are less adsorbent and hence stone masonry walls or buildings are more damp proof.	8. Bricks are of an absorbent in nature and make the buildings damp.
9. The stone possesses high crushing strength and hence the stone masonry is adopted in the construction of piers, docks, dams and other marine structure.	9. The brickwork on other hand is considered unsuitable in the construction of piers, docks, dams and other marine structure.

Q.6	a) Ans.	***Attempt any two:*** ***Draw a neat labeled sectional view showing different components of building from foundation to parapet, for a load bearing brick masonry wall.***	***(12)***

		 Section of Load Bearing Wall	04 M for fig. 02 M for labeling
Q.6	b) Ans .	***As a 'Supervisor', state precautionary measures you will observe while constructing brick masonry, along with their reasons.*** Following Precautionary measures are to be observe as a supervisor while constructing brick masonry: 1. Bricks should be as per the specification. The bricks should be well burnt, reddish in colour, sound and hard. They should have uniform size and shape. 2. The bricks should be saturated with water so as to prevent absorption of moisture from mortar. 3. The bricks should be properly laid on their beds. The bricks should be laid with the frog uppermost. 4. The brickwork should be carried out in proper bond. 5. The mortar to be used for the work should be of good quality and of proportion as specified. 6. In the brickwork, use of brick bats should not be more. 7. The brickwork should be carried out as per line and level. The vertical faces should be checked by means of plumb bob. 8. As far as possible, the brickwork should be raised uniformly. 9. Hold fasts for door should be properly fixed while doing masonry work. 10. Expansion joint should be provided after every 30m to 50m length of wall. 11. The single scaffolding should be adopted to carry out the brickwork at higher level. After construction, the brickwork should be well-watered for a period of about two to three weeks, if lime mortar is used and for a period of about one to two weeks, if cement mortar is used.	1/2 M for each

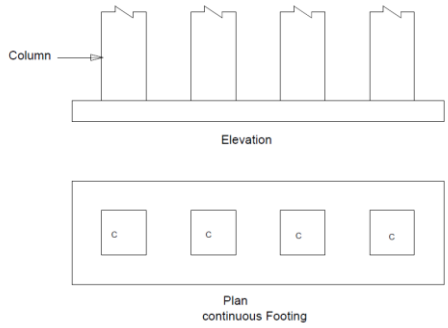
Q.6	c) Ans .	***Draw neat sketches of any three shallow foundations and suggest suitability of them for different loading and soil conditions.*** **Types of shallow foundation with their suitability:** 1. Wall Footing: Wall footings are used for individual columns, walls and bridge piers where the bearing soil layer is within 3m (10 feet) from the ground surface. Soil bearing capacity must be sufficient to support the weight of the structure over the base area of the structure.  Wall Footing 2. Isolated Footing: This foundation is constructed for single column and also called as pad foundation. The footing of concrete columns may be a slab, stepped or sloped type.  Elevation  Plan Isolated Footing 3. Combined Footing: A combined footing provided as a column for two or more columns in a row. Combine footing is also provided when the columns are very near to each other and isolated footing of these column will overlap on each other.  4. Inverted Arch footing: It is suitable to be used for the construction of bridges, tanks,	Any three 02 M for each

underground sewers, and reservoirs. This type of foundation can be used for such structure where the load is concentrated over the column and where it is desired to distribute the load over a large area or in such cases where the bearing capacity of soil is poor.



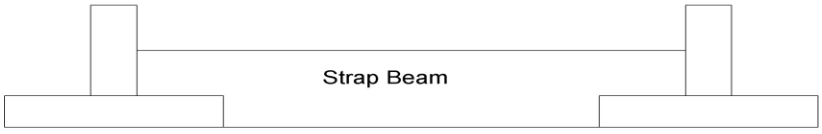
Inverted Arches Footing

5. Continuous Footing: This type of footing is suitable at locations liable to earthquake activities. This also prevents differential settlement in the structure.



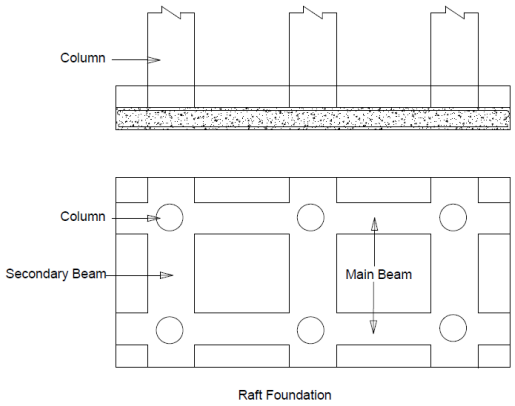
continuous Footing

6. Cantilever Footing/Strap Beam: This type of footing may be used where the distance between the columns is so great that a combined becomes quite narrow with high bending moment.



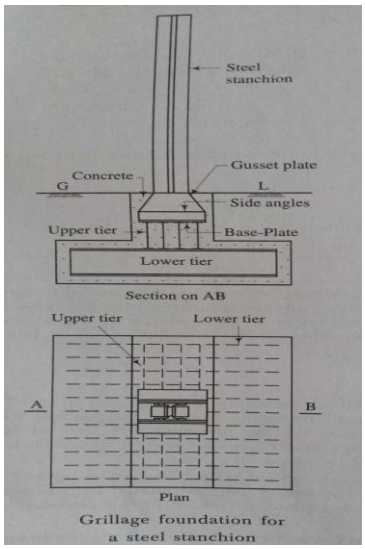
Cantilever Footing/Strap footing

7. Raft Footing: It is suitable where ground is soft. Clayey or marshy having low bearing capacity, and where sub soil water conditions are uncertain. The raft foundation is also used to reduce settlement above highly compressible soils.



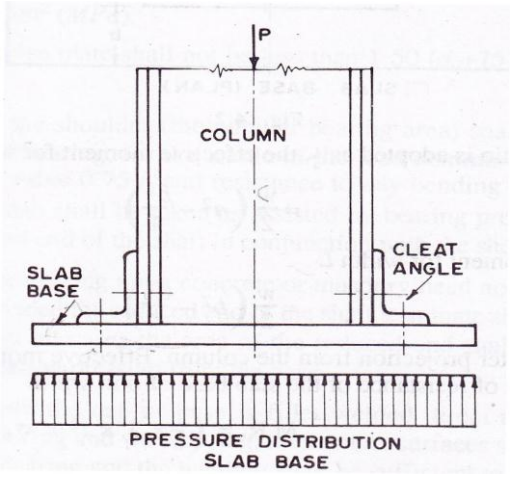
Raft Foundation

8. Grillage Footing : It is suitable where the bearing capacity of soil is very low. It is also suitable where heavy structural load from columns, piers are required to be transferred to a soil of low bearing capacity of soil.



Grillage foundation for a steel stanchion

9. **Slab Base:**



10.Gusseted base: