(21)

GOVT. OF KERALA

DEPARTMENT OF TECHNICAL EDUCATION

OFFICE OF THE CONTROLLER OF TECHNICAL EXAMINATIONS

THIRUVANANTHAPURAM

DIPLOMA EXAMINATION IN ENGINEERING /TECHNOLOGY/MANAGEMENT

CORRECTION NOTE

Revision & Sub code: 2015 - 3011
Subject: CONSTRUCTION MATERIALS AND ENGINEERING.
Verified by:

II

PART - B.

2. The question is - Describe compaction factor test of concrete.

In this question, figure is not mentioned. Therefore, in the scheme, figure may be avoided.

IV a. Two

Tabular columns are confusing. Better to avoid, otherwise modify like this.

Aggregate	Size
coarse aggregate	< 4.75 mm
fine aggregate	> 4.75 mm [0.075 mm - 4.75 mm]
silt	0.002 mm - 0.075 mm
clay	< 0.002 mm

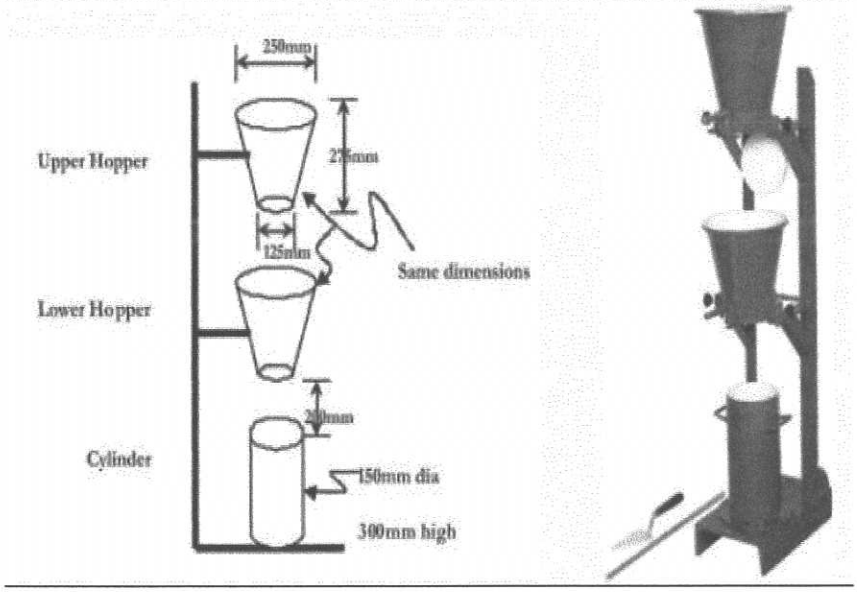
SCHEME OF VALUATION

(Scoring Indicators)

Revision:- 2015 Course Code:3011

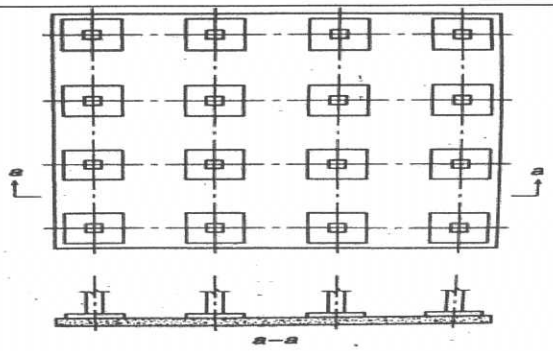
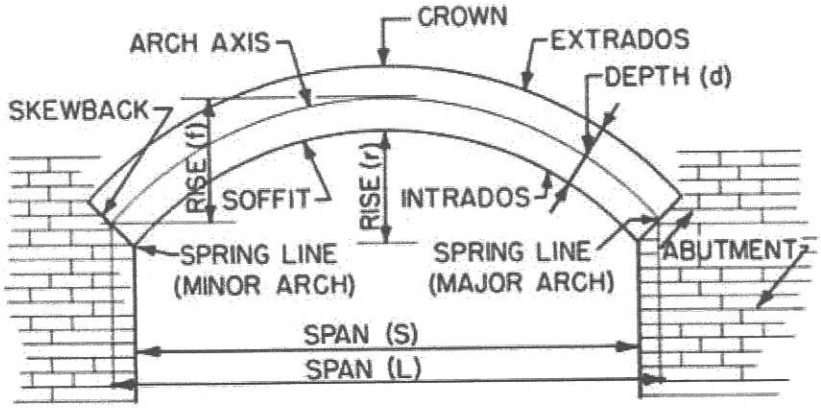
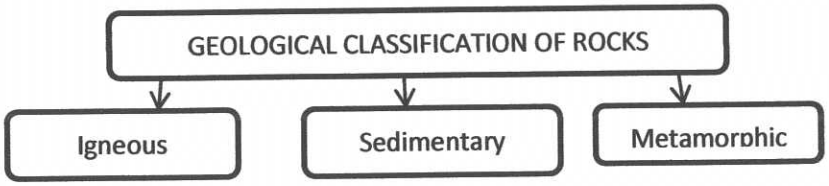
Course Title:-CONSTRUCTION MATERIALS AND ENGINEERING

QN.NO.	SCORING INDICATOR	Split-up score	Sub Total	Total
I.	**PART- A**			
1.	Prestressed concrete is defined as the one in which there have been induced internal stresses of such magnitude and distribution that the stresses resulting from external loading are counteracted to the desired degree.	2		
2.	The process of drying out the water from wet or green timber is termed as seasoning of timber.	2		
3.	A vertical member provided between top rail and lock rail is called as *Mullion.* *Transom* is a horizontal member which divides the door or window frame in to several panels.	1 + 1	2	
4.	**Plaster of Paris** is a type of plaster made from white powder and water which dries quickly. It is used to make plaster casts. A hemihydrate of calcium sulphate, made by calcining gypsum, that hardens when moistened and allowed to dry; used to make casts, moulds and sculpture.	2		
5.	Quick lime reacts with water and increases in volume. The process of chemical combination of lime with such a quantity of water as will readily absorb is called slaking of lime.	2		10
II.	**PART – B**			
1.	The period from the time, water is added to the cement to the time when it loses plasticity is called *initial setting time*. The time corresponding to the paste becoming a hard mass is called *final setting time.* As per IS specification for ordinary Portland cement, the initial setting time should not be less than 30 minutes and final setting time should not be more than 10 hours. It is important to know the initial setting time, because of loss of useful properties of cement if the cement mortar or concrete is placed in moulds after this time. The importance of final setting time lies in the fact that the moulds can be removed after this time.	2 2 2		6
2.	The compaction factor test gives the behaviour of fresh concrete under the action of external force.			

	 In this test, the compaction achieved through a free fall of concrete determines its workability. Procedure • The concrete sample is placed in the upper hopper. • Then the door of hopper is opened. The sample drops into lower hopper filling it to overflowing. • The trap door of the lower hopper is then opened and the sample falls into the cylinder which is also filled to overflowing. • The surplus concrete is removed from the top of the cylinder with the help of a trowel. • The outside surface of cylinder is wiped and cleaned. • The cylinder is then weighed and it is recorded as weight of partially compacted concrete. • The cylinder is again filled with concrete in layers not exceeding 50 mm in thickness. Each layer is fully compacted with tamping rod. • The cylinder is again weighed after wiping and cleaning the outside surface of cylinder. This weight is recorded as the weight of fully compacted concrete. • Then calculate, Compaction factor $= \frac{Weight\ of\ partially\ compacted\ concrete}{Weight\ of\ fully\ compaced\ concrete}$ • As per IS 456 – 2000, compaction factor value suggested as 0.75 to 0.80.	2 4		6
3.	The glass is a mixture of metallic silicates one of which is usually that of an alkali metal. It is amorphous transparent and translucent. It is regarded as super cooled mixture of sodium, potassium and calcium silicates. Different types of glass are manufactured by adding silica in these oxides in varying proportions	3 3		6
4.	1. Brick Masonry are uniform in shape and size while Stone Masonry are not of uniform shape and size.			

3 4

	2. Brick Masonry are light in weight as compared to Stone Masonry. 3. Brick Masonry do not require any dressing while the Stone requires dressing. 4. Stones are not easily available while the bricks are available easily. 5. Bricks laying is easy than Stone Masonry. 6. In brickwork, mortar joints are thin while in Stonework, mortar joints are thick. 7. Brick Masonry are less water tight than Stone. 8. Brick Masonry have better fire resistance than Stone. 9. The cost of construction of brickwork is less. 10. Brick Masonry are not much strong. Stone Masonry are stronger.	Any 6		6
5.	<table><tr><th>PLASTERING</th><th>POINTING</th></tr><tr><td>Plastering is used to protect the exposed surface of the masonry</td><td>In pointing only joints are properly filled with mortar.</td></tr><tr><td>Cement, sand and lime are used in plastering.</td><td>In pointing we use just cement mortar.</td></tr><tr><td>The plastering is done at both sides of surface (inside and outside)</td><td>Pointing is done only at the outer side of the wall</td></tr><tr><td>In plastering work we use the large amount of materials.</td><td>We use less amount of mortar.</td></tr><tr><td>After the plastering the defects of masonry are not visible.</td><td>After the pointing the surface does not become smooth and plain.</td></tr><tr><td>When we plastering the wall, after the plastering work, the surface become smooth and plain.</td><td>In after pointing the defects of masonry can be seen.</td></tr></table>	6		6
6.	Purpose of foundation is to distribute the weight of the structure over large area so as to avoid over loading of the soil beneath. This method of foundation is provided when the soil is of very low bearing capacity such as soft clayey soils. A raft foundation covers entire area of the bottom of the structure like a floor. The raft slab is reinforced in the form of square mask at the bottom.	2 2		

	 Fig: Raft foundation - Plan and Section	2		6
7.	1. Flat arch 2. Segmental arch 3. Semi-Circular arch 4. Horse Shoe arch 5. Pointed arch 6. Venetian arch 7. Florentine arch 8. Relieving arch 9. Stilted arch 10. Semi-Elliptical arch  	3 x 1 = 3 3		(Any three) 6
III. (a)	PART –C UNIT-1 This classification is based on the mode or process of formation of a rock. Thus, some rocks may be formed from natural hot molten materials. Others may be formed at ordinary temperatures from compaction of particles or sediments, and still.  	3		

	(i) Igneous **rocks**: - All those rocks that have been formed by cooling and crystallization from an originally hot and molten material are grouped as Igneous Rocks. Eg:- Granites, Basalts and Traps. (ii) Sedimentary Rocks:-These *Types of Rocks* are also called secondary rocks. At any time, the existing rocks on the surface of the earth are being broken into smaller particles by the natural process of decay and decomposition called *weathering and erosion.* Atmospheric gases, temperature variation, wind, water, and ice are some natural agencies which break the existing rocks into small fragments and sediments. Eg:- Sandstones, Quartzite, Limestones, Dolomites, and Shales. **(iii)** Metamorphic Rocks: This rock type is originally either igneous rocks or sedimentary rocks which have undergone some change in their structure, shape or composition. Eg:- Quartzite, Marble, Slate, Gneiss.	4		7
III (b)	1. The bricks should be table-moulded, well burnt in kilns, copper-coloured, free from cracks and with sharp and square edges. The colour should be uniform and bright. 2. The bricks should be uniform in shape and should be of standard size. 3. The bricks should give a clear metallic ringing sound when struck with each other. 4. The bricks when broken or fractured should show a bright homogeneous and uniform compact structure			

	free from voids. 5. The brick should not absorbs water more than 20% by weight, for first class bricks and 22% by weight for second class bricks, when soaked in water for a period of 24 hours. 6. The bricks should be sufficiently hard. No impression should be left on brick surface, when it is scratched with finger nail. 7. The bricks should not break into pieces when dropped flat on hard ground from a height of about one meter. 8. The bricks should have low thermal conductivity and they should be sound proof. 9. The bricks, when soaked in water for 24 hours, should not show deposits of white salt when allowed to dry in shade. 10. No bricks should have the crushing strength below 5.50 N/mm^2.	8x1 = 8		8
IV (a)	***Aggregates*** are the important constituents of the concrete which give body to the concrete and also reduce shrinkage. Aggregates occupy 70 to 80 % of total volume of concrete **Classification of Aggregates Based on Size** Aggregates are available in nature in different sizes. The size of aggregate used may be related to the mix proportions, type of work etc. the size distribution of aggregates is called grading of aggregates. Following are the classification of aggregates based on size:	2		

Aggregates are classified into 2 types according to size

- Fine aggregate
- Coarse aggregate

1

Fine Aggregate

When the aggregate is sieved through 4.75mm sieve, the aggregate passed through it called as fine aggregate. Natural sand is generally used as fine aggregate; silt and clay are also come under this category. The soft deposit consisting of sand, silt and clay is termed as loam. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent.

Fine aggregate	**Size variation**
Coarse Sand	2.0mm – 0.5mm
Medium sand	0.5mm – 0.25mm
Fine sand	0.25mm – 0.06mm
Silt	0.06mm – 0.002mm
Clay	<0.002

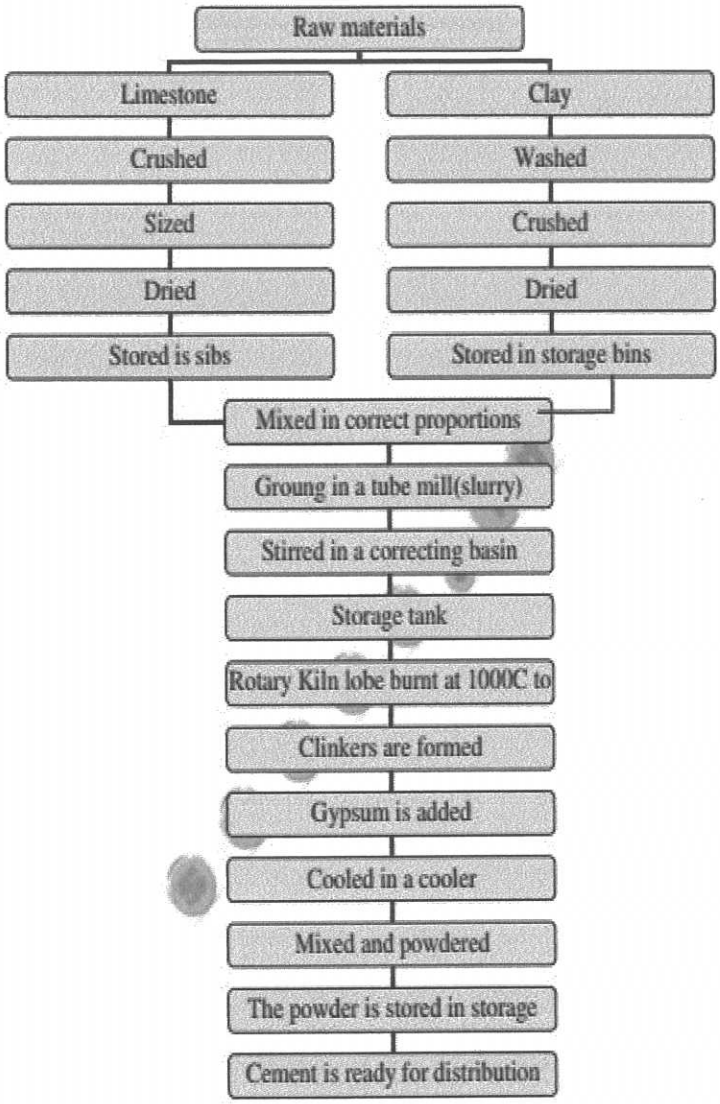
2

Coarse Aggregate

When the aggregate is sieved through 4.75mm sieve, the aggregate retained is called coarse aggregate. Gravel, cobble and boulders come under this category. The maximum size aggregate used may be dependent upon some conditions. In general, 40mm size aggregate used for normal strengths and 20mm size is used for high strength concrete. The size range

	of various coarse aggregates given below. **Coarse aggregate** / **Size** Fine gravel — 4mm – 8mm Medium gravel — 8mm – 16mm Coarse gravel — 16mm – 64mm Cobbles — 64mm – 256mm Boulders — >256mm	2		7
IV (b)	The raw materials required for manufacture of Portland cement are Calcareous materials such as lime stone and chalk and Argillaceous material such as shale or clay. The manufacture procedures of Portland cement is 1. Mixing of raw material 2. Burning 3. Grinding 4. Storage and packing	2		

10



4

In the Wet process, the raw materials are changed to powdered form in the presence of water. Raw materials are pulverized by using a Ball mill, which is a rotary steel cylinder with hardened steel balls. When the mill rotates, steel balls pulverize the raw materials which form slurry (liquid mixture). The slurry is then passed into storage tanks, where correct proportioning is done. Corrected slurry is then fed into rotary kiln for burning.

This process is generally used when raw materials are soft because complete mixing is not possible unless water is added. Actually the purpose of both processes is to change the raw materials to fine powder.

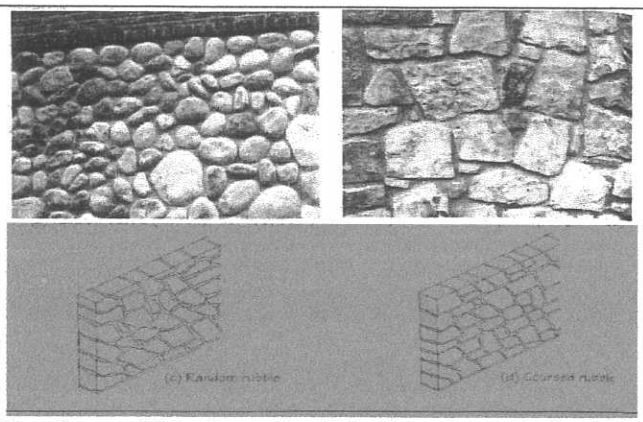
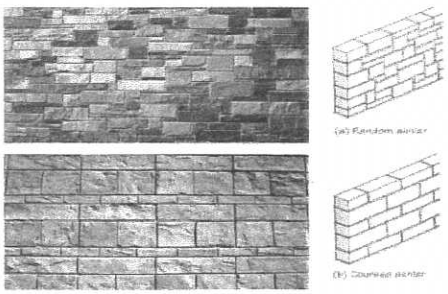
2

8

V.(a)	UNIT-II (i) Paint can be described as fluid paste prepared by dissolving a base into vehicle along with colouring pigment. (ii) 1. Oil paint 2. Enamel paint 3. Cement paints 4. Aluminium paint 5. Distempers.	2 1 x 5		7
V (b)	(i) **Thermo Plastics** Thermo plastics become soft and plastic by heating and harden on cooling without undergoing any chemical change. These can be resoften by reheating and rehardened on cooling without loosing the basic properties. Some of the varieties of thermoplastics are celluloid, styrene, polythene vinylite, nylon etc. The name thermoplastics indicates its property of softening with heat. (ii) **Thermo Setting Plastics** Thermo setting plastics undergo chemical change due to heat or presence of catalyst or due to both during the manufacturing and moulding process and thus gets hardened in the required shape. These plastics remain hardened without cooling and do not soften appreciably even on heating. These plastics set permanently when heated in temperature range of 127^0C to 177^0C and further application of heat and pressure does not alter their shape or soften them.	4 4		8

VI (a)	1. It is very good conductor of heat and electricity. 2. It is a white material possessing great toughness and tensile strength. 3. It is malleable and ductile and very light in weight. 4. It has a very low specific gravity of about 2.6. 5. It is a non-magnetic substance. 6. It is highly resistant to corrosion. 7. It is very soft. 8. It melts at 660^0C. 9. Its boiling point is 2056^0C. 10. It readily dissolves in hydrochloric acid. 11. It can be welded, riveted or brazed but cannot be soldered. 12. It forms useful alloys with iron, copper, zinc and other metals. 13. It has a low surface hardness and can be easily scratched. 14. It can be rolled into turn leaves and can be drawn into wires of small diameter.	1x7		7
VI (b)	**(i) Plywood** is a sheet material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is an engineered wood from the family of manufactured boards which includes medium-density fibreboard (MDF) and particle board (chipboard). **(ii) Varnishes** Varnish is a solution of resin or resinous substances in alcohol, turpentine or oil. It enhances and gives warmth to the grain of the wood and is resistant to impact, heat, abrasion, water and alcohol. It can be used as a topcoat over worn finishes. Varnishing is done	4 2		

	a. To intensify or brighten the appearance of natural grainsin wood. b. To render brilliancy to the painted surface c. To protect painted surface from atmospheric action. d. To protect unpainted wooden surfaces of doors, windows, roof trusses, floors etc. from atmospheric action.	2	4	8
	UNIT-III			
VII (a)	The treatment given to keep the walls, floors and basement dry is termed as damp –proofing. The various ***defects*** caused by dampness in building are:; 1. It causes efflorescence which may ultimately result in disintegration of bricks, stones, tiles etc. 2. It may result in softening and crumbling of plaster. 3. It may cause bleaching and flaking of paint with the formation of coloured patches. 4. It may result in the warping, buckling and rotting of timber. 5. It may lead to the corrosion of metals. 6. It may deteriorate electrical fitting. 7. It promotes growth of termites. 8. It breeds mosquitoes and creates unhealthy living conditions for the occupants.	2 5		Any five 7
VII(b)	Based on the arrangement of the stone in the construction and degree of refinement in the surface finish, the stone masonry can be classified broadly in the following two categories 1. Rubble masonry 2. Ashlar masonry 1) Rubble masonry: In this category, the stones used are either undressed or roughly dressed having wider joints. This can be further subdivided as (a) Uncoursed rubble masonry (b) Random Rubble masonry (c) Coursed rubble masonry (d) Dry rubble masonry	1 2		

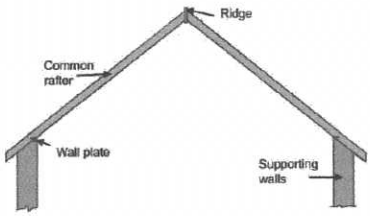
	 Figure: Random rubble (irregular joints) and coursed rubble (regular joints) masonry walls. **Ashlar Masonry** This type of masonry is built from accurately dressed stones with uniform and fine joints of about 3mm thickness by arranging the stone blocks in various patterns. The backing of Ashlar masonry walls may be built of Ashlar masonry or rubble masonry. The size of stones blocks should be in proportion to wall thickness. The various types of masonry can be classified as 1) Ashlar fine 2) Ashlar rough 3) Ashlar rock or quarry faced 4) Ashlar facing 5) Ashlar chamfered 6) Ashlar block in course 	1 1 2 1	4 4	8
VIII (a)	(i) 1. For walls thicker than 1 ½ brick, English bond is stronger than Flemish bond. 2. Flemish bond renders the appearance of the face work more attractive and pleasing. 3. Flemish bond is slightly economical as a number of bats can be used. This renders the uses of broken bricks possible, but requires more mortar for additional joints. 4. The adoption of Flemish bond requires good workmanship and careful supervision. Thus extra attention is necessary to keep the	4	4	

	vertical joints in alternate course one above the other. **(ii) <u>Retaining wall</u>** Retaining wall may be defined as a wall built to resist the pressure of liquid, earth filling, sand, or other granular material filled behind it after it is built. It is commonly required in the construction of hill roads, masonry dams, abutments and wing walls of bridges and so on. Depending upon the site conditions, type of material to be retained and the height of the wall to be constructed. Retaining wall may be built in dry stone masonry, stone masonry, brick masonry, plain cement concrete and reinforced cement concrete.	1 1 1	<u>3</u>	<u>7</u>
VIII (b)	(i) The term ***shoring*** is applied to construction of the temporary structure required to support an unsafe structure. The main objects of shoring are: 1. When the walls of a building develop signs of bulging or leaning outwards, shoring is necessary to prevent further development of the defects. 2. When defective walls of a building are to be dismantled and rebuilt, shoring is resorted to for supporting the floors or roofs connected to that wall. 3. Shoring is necessary to support the super structure when large openings are required to be made in the main walls. Shoring may be essential to give support to the walls of two adjacent buildings when the intermediate building is to be pulled down and rebuilt. **(ii) <u>Under pinning</u>** Under pinning is the process of constructing a new foundation below the existing foundation or strengthening the existing foundation without disturbing the stability of the structure. . The following cases demand underpinning: 1. Increasing the depth of foundation or strengthening the existing foundation to make it more capable of taking more loads. 2. When foundation of building has settled giving rise of cracks in the walls. 3. A new building with deep foundation has to be constructed adjacent to the existing building. 4. When basement is provided below an existing building.	<u>1</u> 3 2 Any 2	<u>4</u> <u>4</u>	<u>8</u>

UNIT-IV

IX (a) The common types of trusses that are used for pitched roofs are

1. Couple roof
2. Couple close roof
3. Collar beam roof
4. Collar and tie roof
5. King Post Truss
6. Queen Post Truss
7. Steel Truss



Couple roof

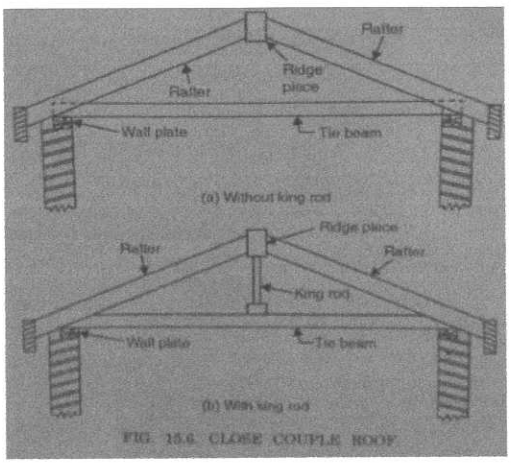


FIG. 15.6 CLOSE COUPLE ROOF

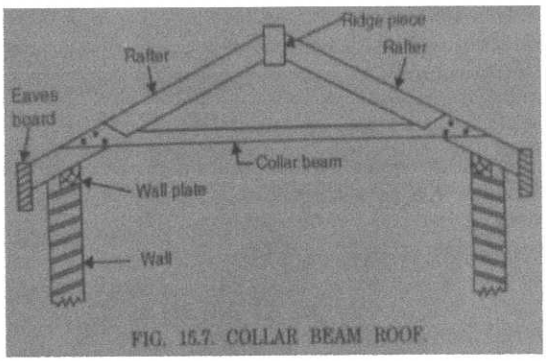
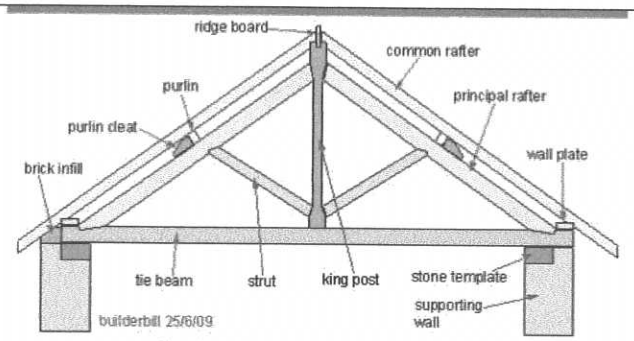
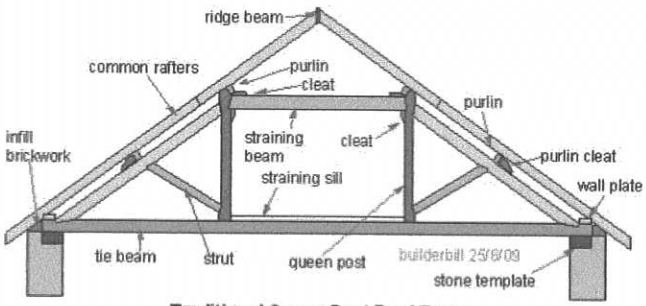


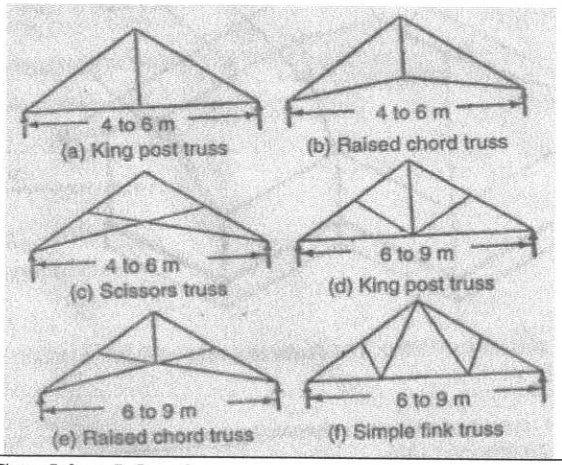
FIG. 15.7 COLLAR BEAM ROOF



Traditional King Post Roof Truss



Traditional Queen Post Roof Truss



7x1 =7

7

IX (b)

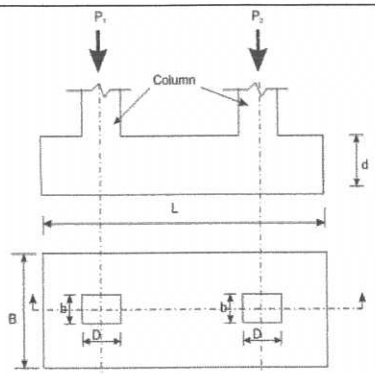
(i) Combined footing

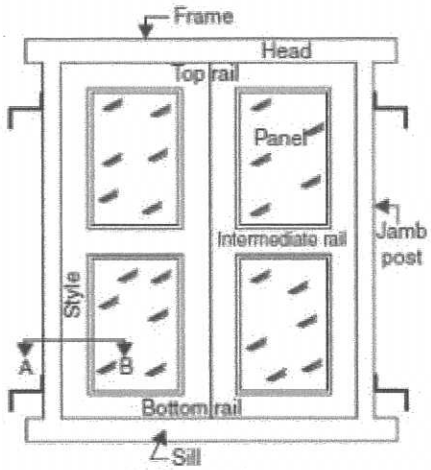
A combined footing is so proportioned that the centre of gravity of the supporting area is in line with the centre of gravity of the two column loads.

A combined footing may be rectangular or trapezoidal in shape. Rectangular shape is only possible where loading condition is such that either the two columns are equally loaded or the interior column carries greater load. On the other hand, in case of trapezoidal footing, no such condition is applicable.

2

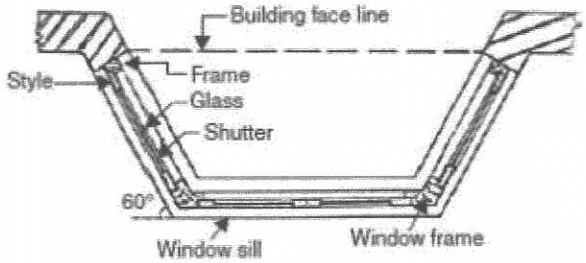
2 figure 4

				
	(ii)Well (Caissons) Foundation The term caisson refers to box or a case. These are hollow inside and are usually constructed at the site and sunk in place into a hard bearing strata. As they are expensive in construction, they are usually restricted to major foundation works. Well foundation are suitable when the soil contains large boulders obstructing the penetration during installation of pier or pile foundations. Caissons are used for bridge piers, abutments in rivers and lakes and other shore protection works. They are used to resist heavy vertical and horizontal loads and are used in the construction of large water front structures as pump houses.	4		8
X(a)	Depending upon the position of windows, they may be classified as: (a) Casement windows (b) Bay windows (c) Corner windows (d) Clerestory windows (e) Gable windows (f) Sky light windows (g) Dormer windows (h) Ventilators Casement windows are common type of windows, provided in the outer walls. They are provided over 50 to 75 mm sill concrete at a height of 750 to 900 mm from floor level.	Any 7		



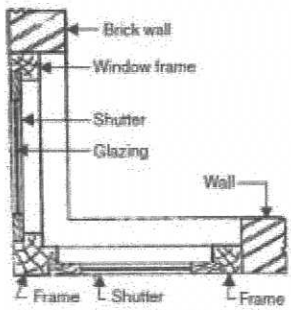
(a) Casement window

Bay windows are provided on the projected portion of walls.



(b) Bay window

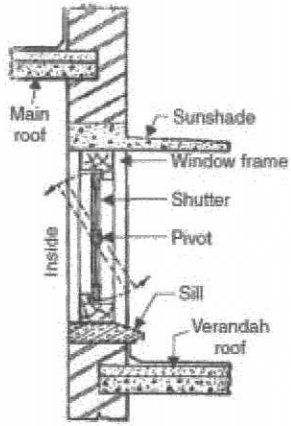
Corner windows are provided in the corner of a room. They need heavy lintels. Corner post of window should be strong enough to take load due to deflection of lintel and impact load from the shutters.



(c) Corner window

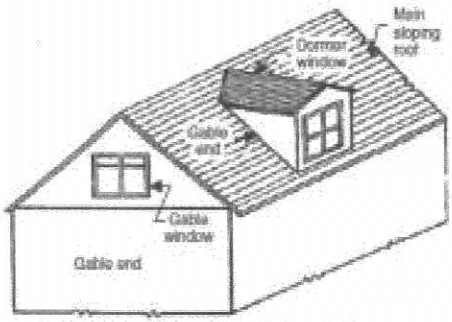
Clearstory windows are provided when the height of the room is much more than adjacent room/varandah. It is provided between the gap of low

height room and the top of room with greater height.



(d) Clear storey window

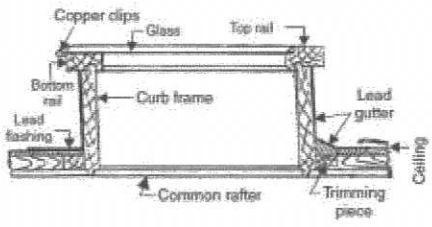
Gable windows are provided in the gable portion of the building. They are required in the stair cases or in the halls with gable walls.



(e) Dormer window and gable window

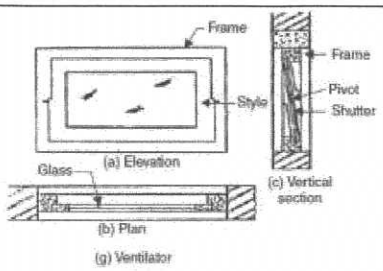
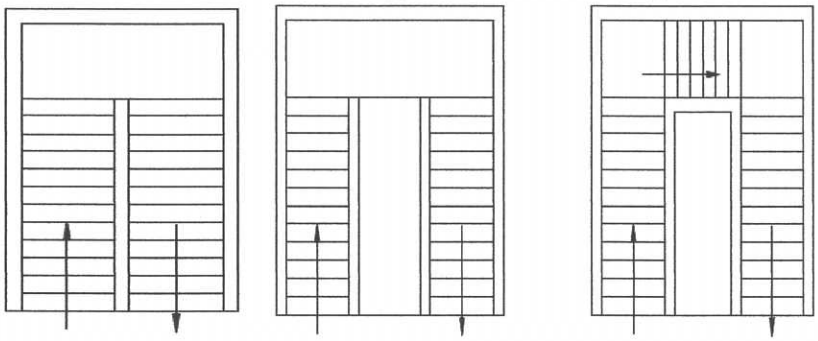
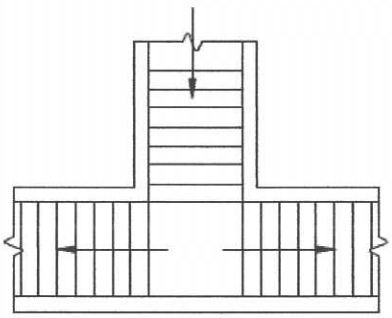
Dormer windows are vertical windows on the sloping roof.

Sky light windows are provided on a sloping roof. It projects above the top sloping surface. The common rafters are to be trimmed suitably.



(f) Sky light

Ventilators are provided close to roof level or over the door frames. They help in pushing out exhaust air. They may be provided with two split and separated glasses or with hung shutters.

	 Fig. 8.33. Types of window on their position			7
X(b)	(i) Two quarter turn stairs (Half-turn stairs) In case of half turn stairs its direction reversed, or changed for 180°. Such stairs are quite common.  Fig(a) Half-turn stairs Fig(b) Half-turn with open-well stairs (ii) Bifurcated stairs  This type of stair is provided in modern public buildings. In this type of stairs, the flights are so arranged that there is a wide flight at the start which is sub-divided into narrow flights at the mid-landing. The two narrow flights start from either side of the mid-landing.	2 2 2 2	4 4	8

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