

TED (15) – 3011
(REVISION — 2015)

Reg. No.
Signature

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

CONSTRUCTION MATERIALS AND ENGINEERING

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. Define Pre-stressed concrete.
2. What is meant by Seasoning of Timber ?
3. Differentiate between Mullion and Transom.
4. What is Plaster of Paris ?
5. What is meant by Slaking of lime ?

(5 × 2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. What are the Initial and Final setting times of Cement ? What is their importance ?
2. Describe Compaction Factor test of Concrete with a sketch.
3. What is Glass ? List the principal constituents of Glass.
4. Compare Brick masonry and Stone masonry.
5. Explain Plastering and Pointing.
6. What is the purpose of providing Foundations ? Explain with sketch a Raft foundation.
7. What are the different types of Arches based on the shape of construction ? Draw a neat sketch of an Arch and mark all its components.

(5 × 6 = 30)

PART — C
(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

- III (a) Explain the Geological classification of rocks. Mention examples for each category. 7
- (b) What are the characteristics of good bricks used for building purpose ? 8

OR

- IV (a) What is meant by Aggregate ? Briefly describe their classification based on size. 7
- (b) Explain with the help of a flow chart, the manufacturing of Ordinary Portland Cement by Wet process. 8

UNIT — II

- V (a) What is Paint ? List any five types of paints commonly used for engineering purposes. 7
- (b) Write short notes on (i) Thermo plastic and (ii) Thermo setting plastics. 8

OR

- VI (a) State any seven properties of Aluminium. 7
- (b) Write short notes on (i) Plywood and (ii) Varnishes. 8

UNIT — III

- VII (a) Define Damp-proofing. What are the various defects caused by Dampness in building ? 7
- (b) Explain the different classification of Stone masonry with neat sketches. 8

OR

- VIII (a) (i) Compare merits and demerits of English bond and Flemish bond. 4
- (ii) What is meant by Retaining wall ? 3
- (b) Explain the following terms (i) Shoring and (ii) Under pinning. 8

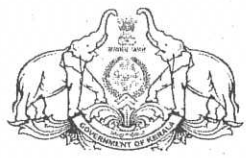
UNIT — IV

- IX (a) Write different types of Trusses for Pitched roofs. Show sketches of each. (Any four) 8
- (b) Write short notes on : 7
- (i) Combined Footing and (ii) Well Foundation

OR

- X (a) Explain with neat sketches different classification of Windows based on the position. 8
- (b) Explain with neat sketches the following types of stairs. 7
- (i) Two quarter turn stairs and (ii) Bifurcated stairs.

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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: 2015-2011
 Subject: CONSTRUCTION MATERIALS AND ENGINEERING,
 Verified by:

I 2. The question is - Describe compaction factor test of concrete. ^{PART-B.}

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

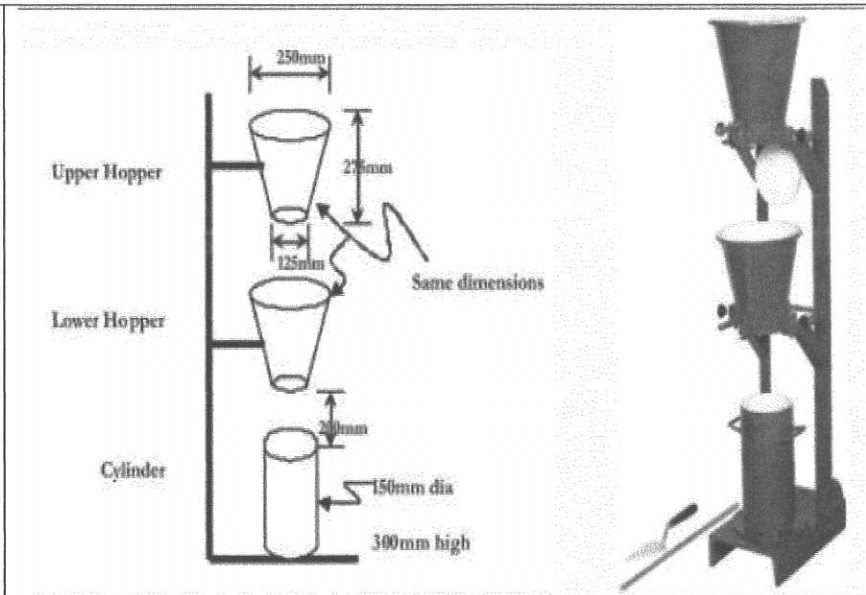
IV a. Two tabular columns are confusing. Better to avoid, and otherwise modify like this.

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.	<u>PART- A</u>			
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 <i>Mullion</i> . <i>Transom</i> 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.	<u>PART - B</u>			
1.	The period from the time, water is added to the cement to the time when it loses plasticity is called <i>initial setting time</i> . The time corresponding to the paste becoming a hard mass is called <i>final setting time</i> . 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,

$$\text{Compaction factor} = \frac{\text{Weight of partially compacted concrete}}{\text{Weight of fully compacted concrete}}$$
- As per IS 456 – 2000, compaction factor value suggested as 0.75 to 0.80.

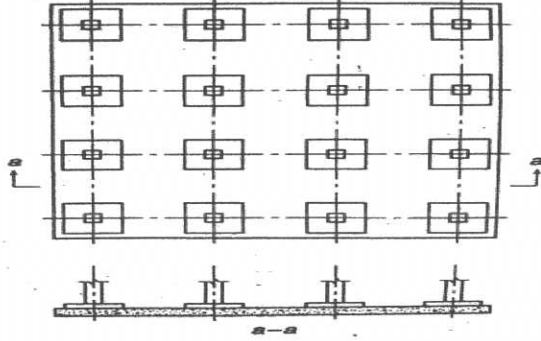
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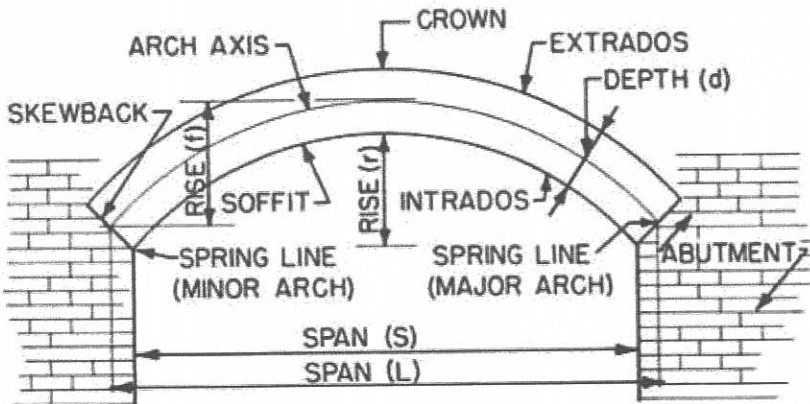
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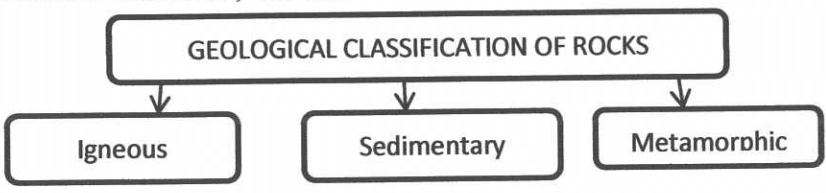
6

3.	<p>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</p>	<u>3</u>		<u>6</u>
4.	<p>1. Brick Masonry are uniform in shape and size while Stone Masonry are not of uniform shape and size.</p>			

	<p>2. Brick Masonry are light in weight as compared to Stone Masonry.</p> <p>3. Brick Masonry do not require any dressing while the Stone requires dressing.</p> <p>4. Stones are not easily available while the bricks are available easily.</p> <p>5. Bricks laying is easy than Stone Masonry.</p> <p>6. In brickwork, mortar joints are thin while in Stonework, mortar joints are thick.</p> <p>7. Brick Masonry are less water tight than Stone.</p> <p>8. Brick Masonry have better fire resistance than Stone.</p> <p>9. The cost of construction of brickwork is less.</p> <p>10. Brick Masonry are not much strong. Stone Masonry are stronger.</p>	<p>Any <u>6</u></p>		<p><u>6</u></p>														
<p>5.</p>	<table border="1"> <thead> <tr> <th data-bbox="279 750 726 795">PLASTERING</th> <th data-bbox="726 750 1220 795">POINTING</th> </tr> </thead> <tbody> <tr> <td data-bbox="279 795 726 862">Plastering is used to protect the exposed surface of the masonry</td> <td data-bbox="726 795 1220 862">In pointing only joints are properly filled with mortar.</td> </tr> <tr> <td data-bbox="279 862 726 929">Cement, sand and lime are used in plastering.</td> <td data-bbox="726 862 1220 929">In pointing we use just cement mortar.</td> </tr> <tr> <td data-bbox="279 929 726 1041">The plastering is done at both sides of surface (inside and outside)</td> <td data-bbox="726 929 1220 1041">Pointing is done only at the outer side of the wall</td> </tr> <tr> <td data-bbox="279 1041 726 1108">In plastering work we use the large amount of materials.</td> <td data-bbox="726 1041 1220 1108">We use less amount of mortar.</td> </tr> <tr> <td data-bbox="279 1108 726 1220">After the plastering the defects of masonry are not visible.</td> <td data-bbox="726 1108 1220 1220">After the pointing the surface does not become smooth and plain.</td> </tr> <tr> <td data-bbox="279 1220 726 1377">When we plastering the wall, after the plastering work, the surface become smooth and plain.</td> <td data-bbox="726 1220 1220 1377">In after pointing the defects of masonry can be seen.</td> </tr> </tbody> </table>	PLASTERING	POINTING	Plastering is used to protect the exposed surface of the masonry	In pointing only joints are properly filled with mortar.	Cement, sand and lime are used in plastering.	In pointing we use just cement mortar.	The plastering is done at both sides of surface (inside and outside)	Pointing is done only at the outer side of the wall	In plastering work we use the large amount of materials.	We use less amount of mortar.	After the plastering the defects of masonry are not visible.	After the pointing the surface does not become smooth and plain.	When we plastering the wall, after the plastering work, the surface become smooth and plain.	In after pointing the defects of masonry can be seen.	<p><u>6</u></p>		<p><u>6</u></p>
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<p>6.</p>	<p>Purpose of foundation is to distribute the weight of the structure over large area so as to avoid over loading of the soil beneath.</p> <p>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.</p>	<p>2</p> <p>2</p>																

	 <p>Fig: Raft foundation - Plan and Section</p>	2		6
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7.	<ol style="list-style-type: none"> 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	(Any three)	6
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III. (a)	<p style="text-align: center;"><u>PART -C</u></p> <p style="text-align: center;"><u>UNIT-1</u></p> <p>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.</p> <div style="text-align: center;">  </div>	3		
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	<p>(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.</p> <p>Eg:- Granites, Basalts and Traps.</p> <p>(ii) Sedimentary Rocks:-These <i>Types of Rocks</i> 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 <i>weathering and erosion</i>. Atmospheric gases, temperature variation, wind, water, and ice are some natural agencies which break the existing rocks into small fragments and sediments.</p> <p>Eg:- Sandstones, Quartzite, Limestones, Dolomites, and Shales.</p> <p>(iii) Metamorphic Rocks:</p> <p>This rock type is originally either igneous rocks or sedimentary rocks which have undergone some change in their structure, shape or composition.</p> <p>Eg:- Quartzite, Marble, Slate, Gneiss.</p>	4		7
III (b)	<ol style="list-style-type: none"> 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 			

	<p>free from voids.</p> <ol style="list-style-type: none"> 5. The brick should not absorb 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/mm². 	<p>$\frac{8 \times 1}{= 8}$</p>		<p><u>8</u></p>
<p>IV (a)</p>	<p><i>Aggregates</i> 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</p> <p>Classification of Aggregates Based on Size</p> <p>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.</p> <p>Following are the classification of aggregates based on size:</p>	<p><u>2</u></p>		

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.

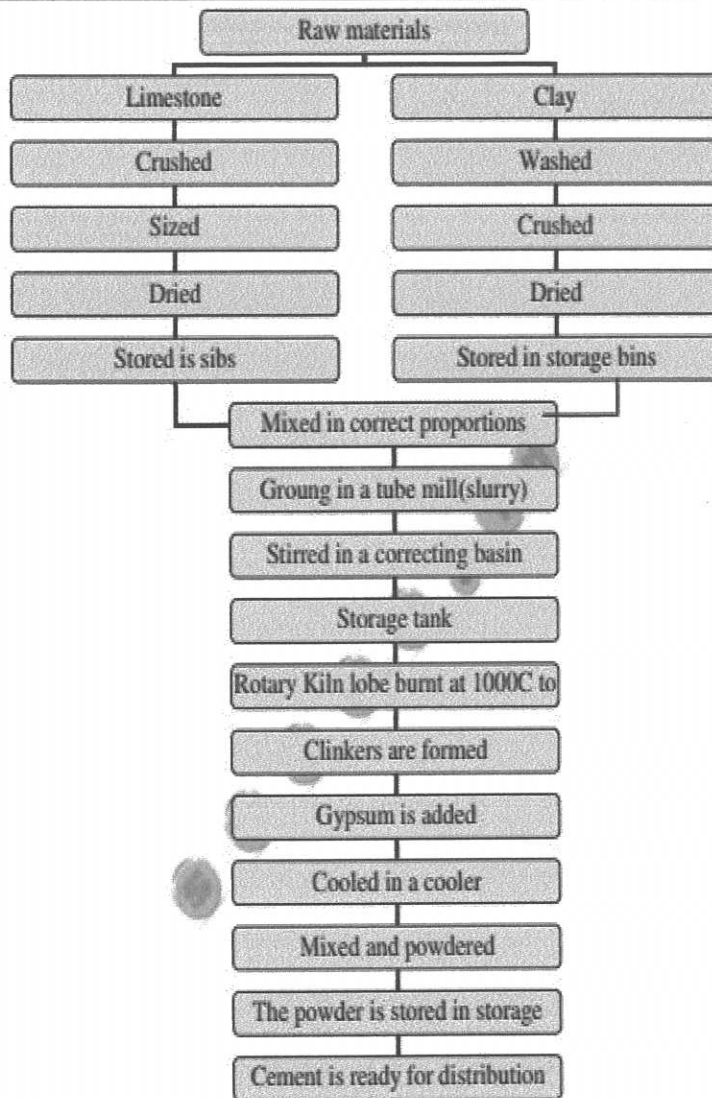
Fine aggregate	Size variation
Coarse Sand	2.0mm – 0.5mm
Medium sand	0.5mm – 0.25mm
Fine sand	0.25mm – 0.06mm
Silt	0.06mm – 0.002mm
Clay	<0.002

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

	<p>of various coarse aggregates given below.</p> <table border="1" data-bbox="434 286 1083 884"> <thead> <tr> <th>Coarse aggregate</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>Fine gravel</td> <td>4mm – 8mm</td> </tr> <tr> <td>Medium gravel</td> <td>8mm – 16mm</td> </tr> <tr> <td>Coarse gravel</td> <td>16mm – 64mm</td> </tr> <tr> <td>Cobbles</td> <td>64mm – 256mm</td> </tr> <tr> <td>Boulders</td> <td>>256mm</td> </tr> </tbody> </table>	Coarse aggregate	Size	Fine gravel	4mm – 8mm	Medium gravel	8mm – 16mm	Coarse gravel	16mm – 64mm	Cobbles	64mm – 256mm	Boulders	>256mm	2		7
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Cobbles	64mm – 256mm															
Boulders	>256mm															
<p>IV (b)</p>	<p>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.</p> <p>The manufacture procedures of Portland cement is</p> <ol style="list-style-type: none"> 1. Mixing of raw material 2. Burning 3. Grinding 4. Storage and packing 	2														



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)	<p style="text-align: center;"><u>UNIT-II</u></p> <p>(i) Paint can be described as fluid paste prepared by dissolving a base into vehicle along with colouring pigment.</p> <p>(ii) 1. Oil paint 2. Enamel paint 3. Cement paints 4. Aluminium paint 5. Distempers.</p>	2		7
V (b)	<p>(i) <u>Thermo Plastics</u></p> <p>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.</p> <p>Some of the varieties of thermoplastics are celluloid, styrene, polythene vinylite, nylon etc. The name thermoplastics indicates its property of softening with heat.</p> <p>(ii) <u>Thermo Setting Plastics</u></p> <p>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.</p> <p>These plastics set permanently when heated in temperature range of 127⁰C to 177⁰C and further application of heat and pressure does not alter their shape or soften them.</p>	4		8

VI (a)	<ol style="list-style-type: none"> 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°C. 9. Its boiling point is 2056°C. 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. 	<u>1x7</u>		<u>7</u>
VI (b)	<p>(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).</p> <p>(ii) Varnishes</p> <p>Varnish is a solution of resin or resinous substances in alcohol, turpentine or oil.</p> <p>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.</p> <p style="text-align: center;">Varnishing is done</p>	<u>4</u>		<u>2</u>

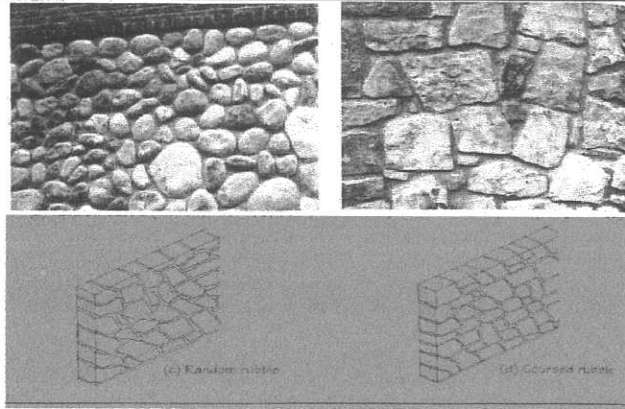


Figure: Random rubble (irregular joints) and coursed rubble (regular joints) masonry walls.

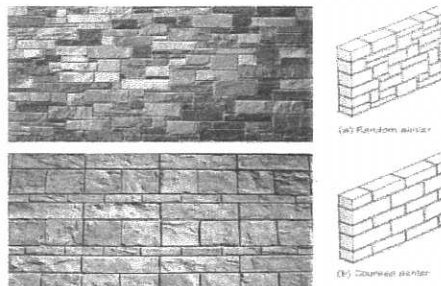
Ashlar Masonry

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



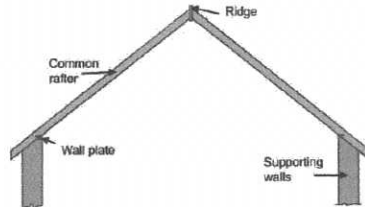
	<p>1</p> <p>4</p> <p>1</p> <p>2</p> <p>1</p>			
<p>VIII (a)</p>	<p>(i)</p> <ol style="list-style-type: none"> 1. For walls thicker than 1 ½ brick, English bond is stronger than Flemish bond. 2. Flemish bond renders the appearance of the face work more attractive and pleasing. 3. Flemish bond is slightly 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 	<p>4</p>	<p>4</p>	<p>8</p>

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

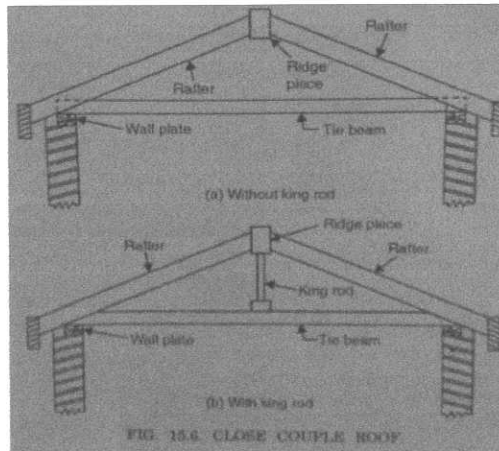


FIG. 15.6. CLOSE COUPLE ROOF

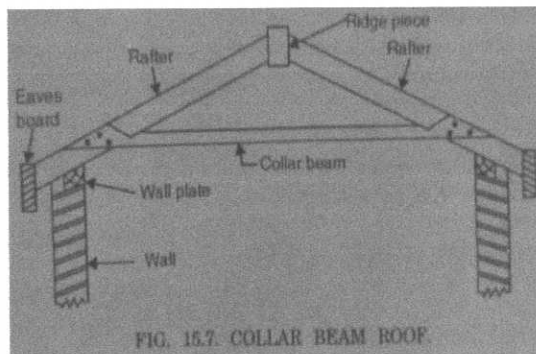
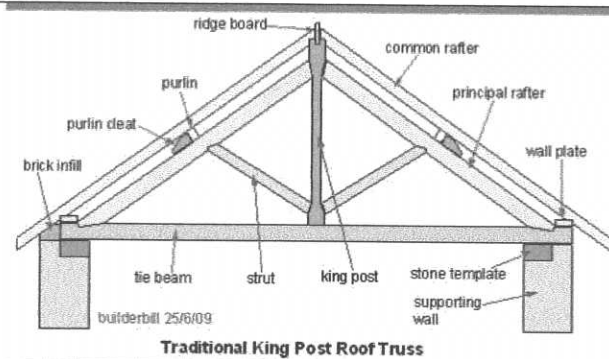
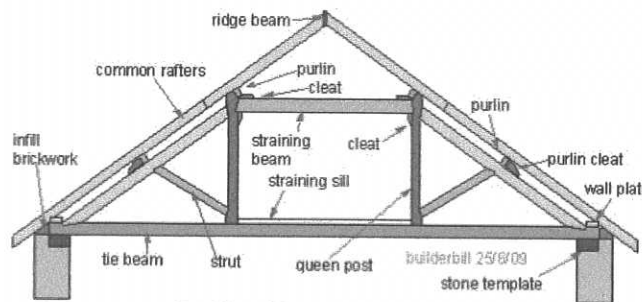


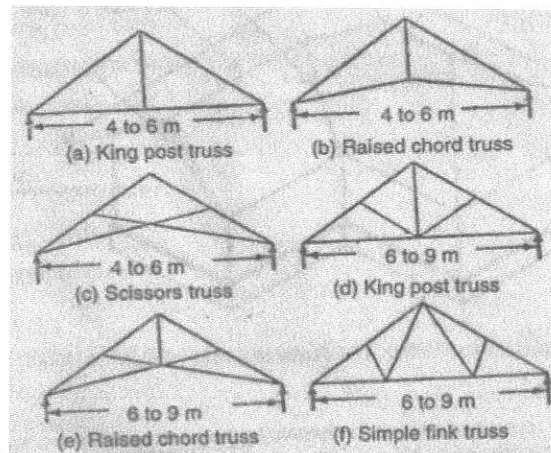
FIG. 15.7. COLLAR BEAM ROOF



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.

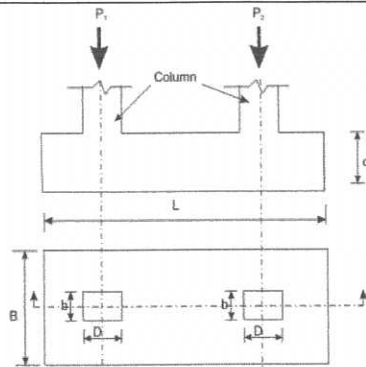
A combined footing may be rectangular or trapezoidal in shape. Rectangular shape is only possible where loading condition is such that either the two columns are equally loaded or the interior column carries greater load. On the other hand, in case of trapezoidal footing, no such condition is applicable.

2

2

figu
re

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)

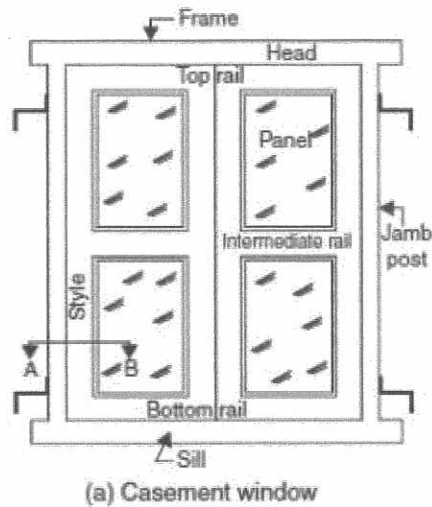
Depending upon the position of windows, they may be classified as:

- (a) Casement windows
- (b) Bay windows
- (c) Corner windows

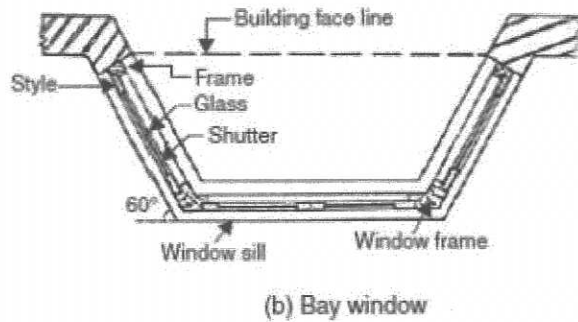
- (d) Clerestory windows
- (e) Gable windows
- (f) Sky light windows
- (g) Dormer windows
- (h) Ventilators

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.

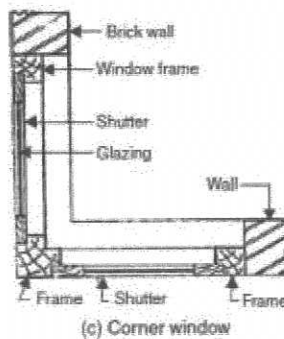
Any
7



Bay windows are provided on the projected portion of walls.

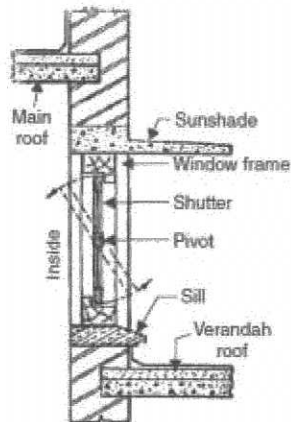


Corner windows are provided in the corner of a room. They need heavy lintels. Corner post of window should be strong enough to take load due to deflection of lintel and impact load from the shutters.



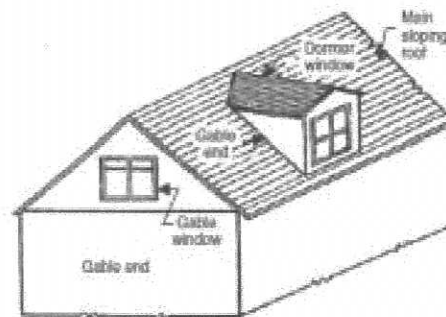
Clearstory windows are provided when the height of the room is much more than adjacent room/varandah. It is provided between the gap of low

height room and the top of room with greater height.



(d) Clear storey window

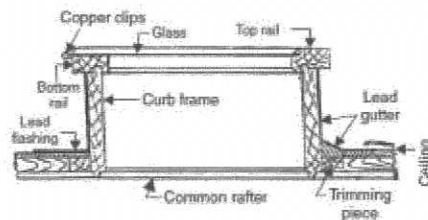
Gable windows are provided in the gable portion of the building. They are required in the stair cases or in the halls with gable walls.



(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.

	<p>Fig. 8.33. Types of window on their position.</p>			<p><u>7</u></p>
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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

4

2

2

4

4

8
