

PART-A

1. alumina=(20-30%),silica=50%,lime=5%,oxide of iron-5%to6%
2. The product obtained by slaking of quick lime is known as slaked lime.
3.
 - alkali barium silicate glass,
 - alumino silicate glass
 - bullet proof glass
 - fibre glass
 - Float glass
 - Foam glass
 - Glass blocks
 - Glass ceramics
 - Heat excluding glass
 - Lead crystal glass
 - Patterned glass
 - Optical glass
 - Perforated glass
 - Photo chromic glass
 - Pyrax glass
 - Safety glass
 - Sealing glass
 - Shielding glass
 - Silica glass
 - Soluble glass
 - Structural glass
 - Wired glass
 - Ultra violet ray glass
 - Technical glass (any two)
4. Damp proof course
5. The important building components are foundation, plinth, masonry or RCC walls, basement, sills, lintels, weather sheds, doors, windows, roofs, stairs, lifts, ramps, plastering, painting, whitewashing ,etc

PART-B

II

1.

- Drain tiles: they are prepared in such a way that they are porous texture after burning. They are laid in water logged areas; allow subsoil water to pass through. they may be circular, semi circular or segmental.
- Floor or paving tiles: They may be square or hexagonal in shape. these are flat tiles with 12mm to 50mm thickness. The size of square tile is 150mm to 300mm
- Roof tiles: these tiles are used to serve as covering for pitched roof
- Pan tiles: they are short and heavy .they are given required curvature by moulding. they are 330mm to 380mm length and 230mm to 280mm width
- Pot tiles: they are ordinary half round country tiles. They are prepared on potters wheel and polishing inner and outer surfaces.

$$1.2 \times 5 = 6$$

2. The composition of cement consist of:

- Lime-62 to 67%
- Silica-17 to 25%
- Alumina-3 to 8%
- Calcium sulphate-4%
- Iron oxide-3%
- Magnesia-2%
- Sulphur-1%
- Alkalies-1%

(6)

3.

- i. It can be cut and sawn without any difficulty
- ii. It is good insulator of electricity and sound
- iii. It is light in weight
- iv. It is not attacked by heat and moisture
- v. It is porous
- vi. It is resilient and reasonably elastic

(any 6) (6).

4.

- i. The English bond is found to possess more strength than Flemish bond for walls having thickness greater than $1\frac{1}{2}$ bricks
- ii. Make use of brick bats in Flemish bond, hence more mortar will be required.
- iii. Construction of Flemish bond require greater skill compared to English bond

5. The plaster may be applied in 2 or 3 coats. The mortar joints are raked out to a depth of 20mm and the surface is cleaned and well watered. It is found that the surface to be plastered is very rough and uneven a preliminary coat is applied to fill up the hollows before the first coat of plaster is put up on the surface. The usual thickness of first coat of brick masonry is 9mm to 10mm. in order to maintain uniform thickness the screeds are formed on the wall surface. to fix a dot, small quantity of plaster is laid on the surface making roughly a square of 150mmx150mm. another dot is vertically below at a distance of 2m. A vertical strip of mortar is formed between dots. The second coat of plaster is applied after about 6 hours and thickness is about 3mm to 2mm. the completed work is allowed to rest 24 hours.

(6).

6.

- i. It gives rise to breeding of mosquitoes and creates unhealthy conditions
- ii. Metals in construction gets corroded
- iii. Unsightly patches are formed on wall surfaces
- iv. Decay of timber takes place rapidly due to dry rot in a damp conditions
- v. Electrical fittings are deteriorated
- vi. Material used in floor coverings are damaged
- vii. Accelerates growth of termites
- viii. Softening and crumbling of plaster
- ix. Materials re damaged, it leads to difficult and costly repairs.

(any 6). $1 \times 6 = 6$.

7.

- i. To distribute the total load acting on the structure on a larger area
- ii. To support the structures
- iii. To give enough lateral stability to the structures against various horizontal forces such as wind, rain, earthquake etc.
- iv. To prepare a level and hard surface surface for concreting and masonry work.
- v. To transmit the superimposed loads through side friction and end bearing in case of deep foundations

(any 6) $1 \times 6 = 6$.

- vi. To distribute the non uniform load of the superstructure to the sub soil.
- vii. To provide natural safety against undermining or scouring due to animals, flood water etc.
- viii. To prevent or minimize cracks due to movement of moisture in case of weak or poor soils etc.

PART-C

III

- a) The building stones are classified in the following three ways:
 - i. Geological classification
 - ii. Physical classification
 - iii. Chemical classification

Geological classification: they are classified into 3 types

- Igneous rocks: the inside portion of earth surface has high temperature so as to cause fusion by heat at even ordinary pressures. the molten or pasty rocky material comes out earth surface through cracks, or weak portion called magma.
- Sedimentary rocks: these rocks are formed by the deposition of products of weathering on pre existing rocks. all products of weathering are ultimately carried away from their place of origin by agents of transport.
- Metamorphic rocks: these rocks are formed by change in character of pre existing rock. The igneous as well as sedimentary rocks are changed in character when they are subject to great heat and pressure.

Physical classification: they are classified into 3 types:

- Stratified rocks: these rocks possess planes of stratification or cleavage and such rocks can split up along these planes.
- Unstratified rocks: the structure may crystalline or granular in structure.
- Foliated rocks: they have a tendency to be split up in definite direction only.

Chemical classification: they are classified into 3 types

- Silicious rocks: in these rocks silica predominates, the rocks are hard and durable
- Argillaceous rocks: in these rocks clay predominates
- Calcareous rocks: in these rocks calcium carbonate predominates

b) . In process of manufacturing of bricks the following 4 distinct operations are involved:

- Preparation of clay

The top layer of soil 200mm in depth is taken off and thrown away called unsoiling. the top soil is full of impurities and thus rejected. the clay is dug out from the ground and spread on the leveled ground. the height of heaps of clay is 600mm to 1200mm. the clay should be cleaned of stones, pebbles, vegetable matter etc. The clay is exposed to atmosphere for softening for few weeks. the clay is made loose any ingredient added to it is spread out at top. the water is added to required quantity and kneaded and pressed by feet of men or cattle. (2)

- Moulding: the clay prepared is sent for moulding

There are 2 ways of moulding:

- Hand moulding:

Bricks are moulded manually and used for manufacture of brick on small scale. The wooden moulds are made longer by about 8% to 12% in all directions they are of 2 types ground moulded bricks and table moulded bricks.

ground moulded bricks : The ground is made leveled and fine sand sprinkled over it. the lump of tempered clay is taken in mould. clay is pressed or forced in mould the mould is then lifted up and raw brick is left on ground.

Table moulded bricks: the moulder stands near a table of size 2m x 1m.

- Machine moulding: this is achieved by machines and used when huge quantity of bricks are manufactured. (2)

- Drying: for drying bricks are laid longitudinally in stacks . a stack contain 8 or 10 tiers. the bricks should be allowed to dry till they become leather hard or bone dry with moisture content of about 2% (2)

- Burning: when the temperature of dull heat of about 650°C is reached organic matter contained in brick is oxidized and also water of crystallization is driven away, when 1100°C is reached, the alumina and sand bind themselves together results in increase in strength and density. (1 mark)

IV

a) The water in the tree is removed before using for engineering purpose. In other words timber is to be dried. the process of drying of timber is known as seasoning of timber. The different methods of seasoning are: (2)

- i. Natural seasoning: in this method seasoning of timber is carried out by natural air also called air seasoning. the timber in log form is cut and sawn into suitable section of planks. the timber pieces are stacked horizontally or vertically, the timbers are arranged in layers one above the other .

Advantages:

- Moisture content of wood can be reduced to 1 to 20%
- Doesnot require skilled supervision.
- It is uneconomical for timber sections thicker than 100mm
- It is cheap and simple

Disadvantages

- It depends on natural air it sometimes becomes difficult to control it
- The drying of different surfaces may not be even and uniform.
- If not properly attended fungi or insects may get attacked
- Process of seasoning is slow
- Space required for this process will be more

(1 mark)

- ii. Artificial seasoning:

- Boiling: timber is immersed in water and water is boiled. it is a very quick method, timber is boiled with water about 3 to 4 hours and dried slowly under a shed.
- Chemical seasoning: this is also known as salt seasoning. timber is immersed in a suitable salt and taken out and seasoned in ordinary way.
- Electrical seasoning: In this method the use is made of high frequency alternating currents. the timber in green offers less resistance to flow of electric current .the resistance increases as the wood dries internally also results in production of heat.
- Kiln seasoning: timber is carried out in a airtight chamber or oven. the timber is arranged inside the chamber such that spaces are left for free circulation of air. The air which is fully saturated is heated upto 35°C to 38°C. the forced air circulate among timber pieces and evaporation from timber pieces is reduced.
- Water seasoning: timber is cut into pieces and immersed in wholly in water, in running water. The thicker or larger end points upstream side. timber is taken out after a period of 2 to 4 weeks and allowed to dry under a shed having free circulation of air.

(1x5 = 5 marks)

b) The properties of cement concrete are as follows:

- i. It has high compressive strength
- ii. It is free from corrosion and there is no appreciable effect of atmospheric agents on it
- iii. It hardens with age and the process of hardening continues for a long time after the concrete has attained sufficient strength
- iv. It is proved to be more economical than steel.
- v. It binds rapidly with steel
- vi. There is initial shrinkage due to loss of water through forms, absorption by surfaces of forms etc
- vii. It has a tendency to be porous due to presence of voids.

V

a) a paint consist of following constituents:

- Base: a base is a solid substance in a fine state of division and it forms a bulk of a paint.it imparts durability to the surface which is painted..it reduces shrinkage cracks and forms an opaque layer .
- Vehicle: they are the liquid substances which hold the ingredients of a paint in liquid suspension. It helps to spread the paint evenly and uniformly o the surface with thin layer .it provide a binder for ingredients of a paint so that they may stick to the surface
- Driers: thses substances accelerate the process of drying. a drier absorbs oxygen from the air and transfers to the linseed oil which in turn gets hardened
- Colouring Pigments: when it is desired to get different colours ,a colouring pigment is to be added. The pigments are available in form of fine powders in various colours and qualities.
- Solvents: the function of solvent is to make paint thin so that it can be easily applied on the surface. The most commonly used solvent is spirit of turpentine.

b) The aluminum used in building industry usually takes one of the following four forms

- Casting based:the applications of this form are
 - i. baluster head which gives elegance to the interior buildings
 - ii. hardware and fittings
 - iii. security and decorative grills
- extrusion based: the applications of this form are
 - i. door and window frames

- ii. curtain walls
 - iii. spacegrids
 - iv. roof top gardens
 - v. hardware and fittings
 - vi. north light glazing frames
 - vii. partitions and space dividers
- foil and powder based
 - i. decorative laminate
 - ii. insulative foils
 - iii. paints
 - iv. water proofing sheets
 - sheet based
 - i. cable tray
 - ii. false ceilings
 - iii. prefabricated houses
 - iv. rain water articles
 - v. ridging and angles of roof
 - vi. roofing

VI

a) The properties of rubber are

- i. it can absorb shocks due to impact
- ii. it can contain liquids and gases
- iii. it creeps or extends or undergoes low deformation in length as a result of applied force
- iv. it is a bad conductor of heat
- v. it is plastic in nature and moulded into desired shapes
- vi. it possesses the quality of flexibility
- vii. it resists abrasion in better way
- viii. the natural rubber should be protected from sunlight and should not come in close contact with oils, organic liquids etc,
- ix. it undergoes great deformation without structurally damaged
- x. the synthetic rubber offers great resistance to acids, petroleum products etc.

b) The different forms of bitumen are:

- i. Bitumen emulsion: it is a liquid product containing bitumen to a great extent in aqueous medium. the bitumen is a very finely divided state and suspended in aqueous medium with the help of stabilizing agents (2)
- ii. Blown bitumen: it is a special type of bitumen obtained by passing air under pressure at a higher temperature, they are used as roofing and damp proofing felts, manufacture of pipe asphalts, joint fillers ,as heat insulating materials etc (2)
- iii. Cut back bitumen: it is obtained by mixing asphaltic bitumen in presence of suitable liquid distillates of coal tar or petroleum (1)
- iv. Plastic bitumen: it consists of bitumen, thinner and suitable inert filler. The amount of inert filler is about 40% to 45%.it is used for filling cracks in masonry structures, for stopping leakages (1)
- v. Straight run bitumen: when the bitumen is distilled to a definite viscosity or penetration without further treatment it is known as straight run bitumen. (1)

VII

a) the causes of dampness are the following:

- i. Rising of moisture from the ground: the ground on which the building is constructed may be made of soils which easily allow water to pass.
- ii. Action of rain: if the faces of wall exposed to heavy rain are not suitably protected they become the sources of entry of dampness in a structure.
- iii. Exposed top of walls: the parapet walls and compound walls should be provided with a damp proof course on their exposed tops.
- iv. Condensation: the warm humid air is cooled, the moisture is deposited on walls, floors and ceilings
- v. Miscellaneous causes of dampness: if the structure is located on a site which is not easily drained off dampness will enter the structure, the walls obtain heavy showers of rain are liable to become damp. The newly constructed walls remain damp for a short duration. Dampness is caused due to bad workmanship.

(any 8 $1 \times 8 = 8$)

b) The requirements of a form work are:

- i. Easy removal
- ii. Economy

- iii. Less leakage
- iv. Quality
- v. Rigidity
- vi. Smooth surface
- vii. Strength
- viii. Supports

(any 7) (7)

VIII

a) The defects in plastering are:

- i. Blistering of plastered surface: the small patches swell out beyond the plane of plastered surface
- ii. Cracks: these are formed on the plastered surface and may be hair cracks or cracks .the development of fine hair cracks is called crazing.
- iii. Efflorescence: The soluble salts are present in plaster making materials as well as building materials such as brick,sand,cement etc.when newly constructed wall dries out the soluble salts are brought to the surface and they appear in the form of whitish crystalline substance.such a growth is referred to as efflorescence.
- iv. Flaking:the formation of loose mass on the plastered surface is known as flakingand mainly due to bond failure between successive coats of plaster.
- v. Peeling:the plaster from some portion of the surface comes off and a patch is formed.such formation is known as peeling.
- vi. Popping: sometimes the plaster mix contain particle which expand on being set.A conical hole in plastered surface is formed in the front of the particle.this is known as blow or pop.
- vii. Rust stains:they are sometimes seen in plastered surface especially when the plaster is applied on the metal lath.
- viii. Softness: the excessive dampness at certain points on the plastered surface makes that portion soft.the chief reasons for such softness are undue thinness of finishing coat,presence of deliquescent salts,excessive suction of the undercoat etc.
- ix. Uneven surface:this defect become prominent only due to poor workman ship.

(any 8) (8)

VIII

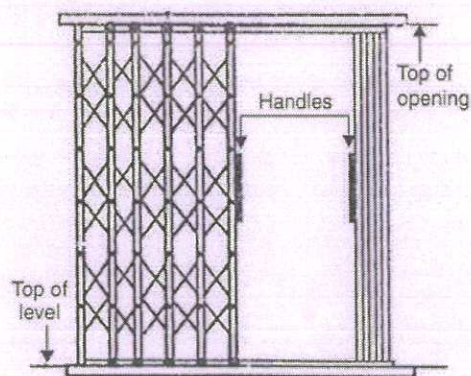
b) the types of shoring are:

- i. Raking or inclined shores: In this arrangement inclined supports are given to external walls from the ground. a raking shore consist of wall plate, needles, cleats, rakers, bracings, sole plate etc. the wall plate is secured by means of needle which penetrate into the wall for a distance of about 150mm. the rakers are interconnected by struts or braces or lacings. (3)
- ii. Flying or horizontal shores: In this arrangement the horizontal supports are given to parallel walls which have become unsafe due to removal or collapse of intermediate building. a single flying shore consist of wall plate, needles, cleats, struts, straining pieces and folding wedges. The flying shores should have a depth not less than one-thirtieth of the clear span and width not less than one-fiftieth of length. (3)
- iii. Dead or vertical shores: In this arrangement the horizontal members known as needles are supported by vertical members called dead shores. the needles are driven at right angles to the wall through the holes made on the wall. a dead shore is used when the lower part of wall has become defective, the foundations are to be deepened, lower part of wall is to be rebuilt, large openings are to be made in existing wall. (1)

IX

a)

Collapsible steel doors:-



A collapsible steel door consist of mild steel frame. The two vertical pieces of mild steel channels about 15mm to 20mm wide are joined together with the hollow portion of channel inside. A vertical gap of

12mm to 15mm is thus created. such pieces are spaced at 120mm centre to centre and are joined to one another by cross iron pieces. the cross iron pieces are 10mm to 15mm wide and 15mm thick. the rollers are mounted on the horizontal piece are provided at the top and bottom ends of the vertical pieces. the door can be opened by slight pull or push. the door is provided with handles, locking arrangement, stoppers etc.

(4)

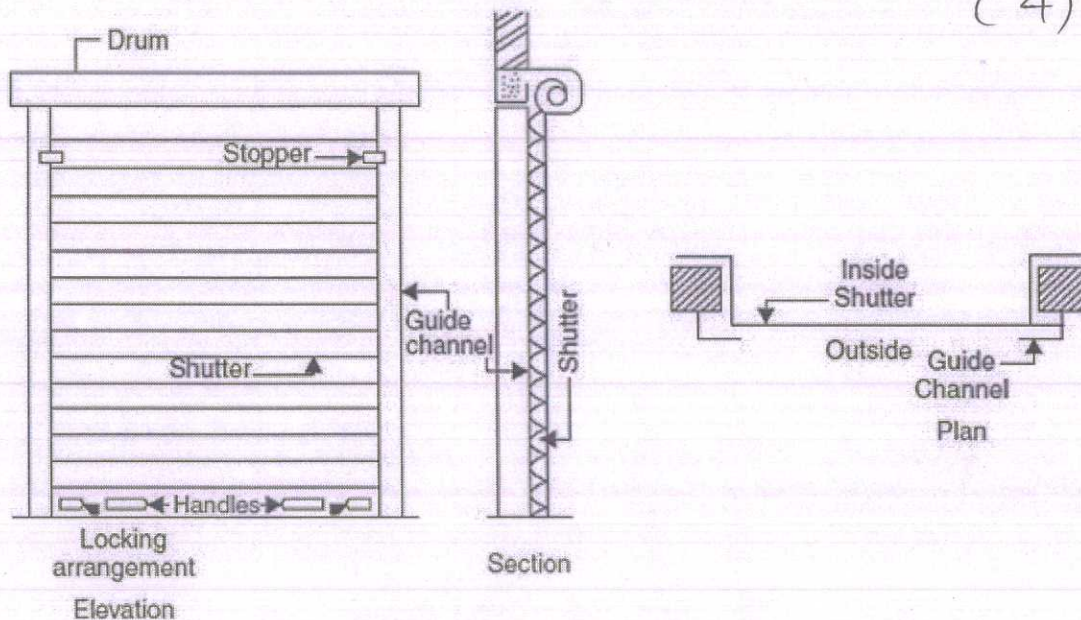


Fig. 8.30. Rolling shutter

Rolling steel door consist of a frame, a drum and a shutter of thin steel plates or iron sheets of thickness about 1mm. the grooves of about 25mm thickness are left in frame. A horizontal shaft and springs are provided in the drum at the top. the diameter of drum is 200mm to 300mm. the shutter usually rolls in turns. thus a slight push or pull will close or open the shutter. they are provided for garages, show rooms, shops, godowns, factory buildings etc.

(4)

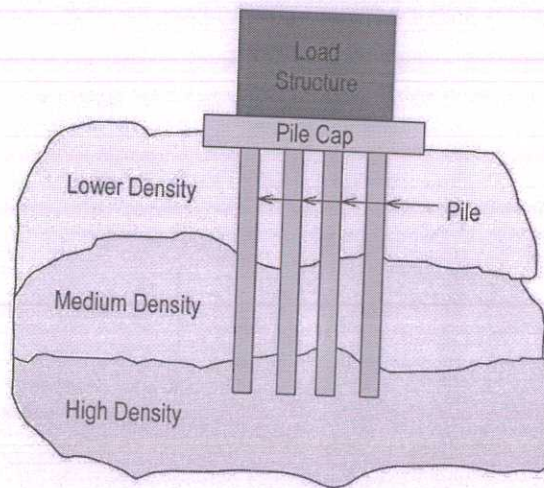
b)

- i. It should give hard and smooth surface
- ii. It should give Adequate strength and stability
- iii. It should be damp resistant
- iv. It should have good thermal insulation capacity
- v. It should be durable and easy to maintain
- vi. It should be fire resistant
- vii. It should give aesthetic look

(any 7) 1x7 = 7)

X

a)



Piles are used to transmit the load of the structure to the soil. pile foundations are used under the following

- i. The load coming from the structure is very heavy and the distribution of load of soil is uneven
- ii. The sub soil water level is likely to rise or fall appreciably .
- iii. The pumping of subsoil water is too costly for keeping the foundation trench in dry condition.
- iv. The construction of raft or grillage foundations is likely to be very expensive is practically impossible.
- v. The firm bearing stratum exists at a greater depth.
- vi. The timbering of excavations is too difficult to maintain the sides of the foundation trench
- vii. The pile foundations is to be adopted for the structures in the area where canals, deep drainage lines etc are to be constructed in near future.
- viii. The structure is situated on seashore or riverbed and the foundation is likely affected by scouring action of water.
- ix. The piles are used as anchors. They may be designed to give lateral support or to resist an upward pressure or uplift pressure.
- x. The piles are used as fender piles in the construction of docks, piers and other marine structures.

(4)

Well foundation

- Well foundation is a type of deep foundation which is generally provided below the water level for bridges.
 - i. Box cassion:
 - It is open at the top and closed at the bottom and is made of timber, reinforced concrete or steel. This type of cassion is used where bearing stratum is available at shallow depth.
 - (ii) Open cassion (wells):
 - Open cassion is a box opened both at top and bottom. It is made up to either timber, concrete or steel. The open cassion is called well. Well foundation is the most common type of deep foundation used for bridges in India.
 - (iii) Pneumatic cassions has its lower end designed as a working chamber in which compressed air is forced to prevent the entry of water and thus excavation can be done in dry conditions.

Shapes of Wells:

The common types of well shapes are:

- (i) Single circular
- (ii) Twin circular
- (iii) Dumb well
- (iv) Double-D
- (v) Twin hexagonal
- (vi) Twin octagonal
- (vii) Rectangular.

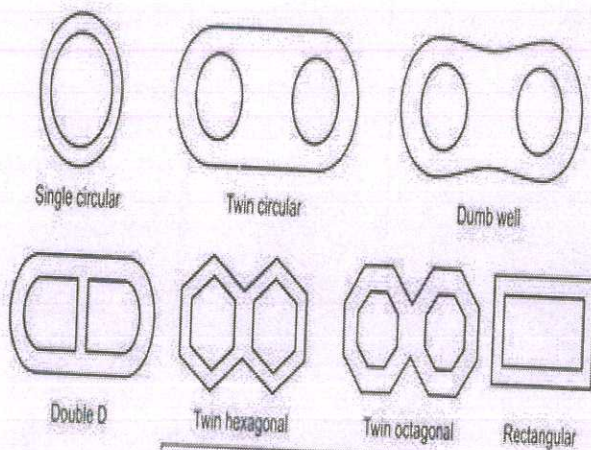


FIG. 11.30 Different shapes of wells

(4)

X b)

Double hung window

- The windows consist of a pair of shutters which can slide within the grooves
- A pair of weights connected on each sash
- Upper sash moves in downward direction
- Lower sash moves in upper direction
- Ventillation is controlled and cleaning can be done easily

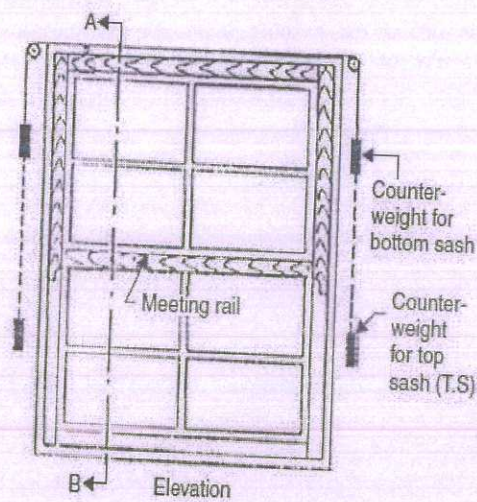


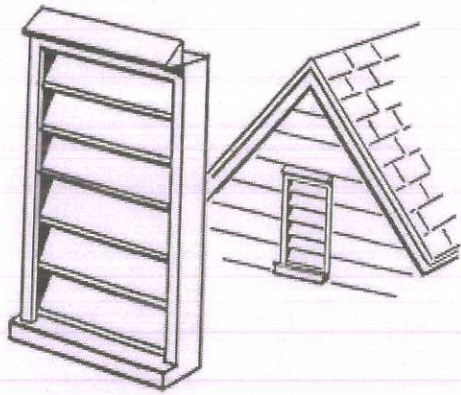
Fig. 8.32. Double hung window

(3.5 marks)

Louvered window

- Louvers are provided for this type of windows.
- These allow free passage of air when closed at the same time they maintain sufficient privacy
- Shutter consist of top rail, bottom rail and styles grooved to receive louvers
- Inclination of louvers is 45°
- It is raised or lowered by mechanical operating device.

(3.5 marks)



SCHEME OF VALUATION
(Scoring Indicators)

Revision: 2015		Course Code: 3011		
Course Title: Construction Materials and Engineering				
Qst. No	Scoring Indicator	Split up score	Sub Total	Total
<u>PART A</u>				
I		2	2	
I(i) 1	Composition of brick	2	2	
I(ii) 2	slaked lime	1x2=2	2	
3	Any two types of glass	2	2	
4	adhesive	2	2	
5	Any two Building components	2	2	10
<u>PART B</u>				
II(i)	• Drain tiles	1.2	} 6	
	• Floor or paving tiles.	1.2		
II(ii)	• Roof tiles	1.2		
	• Pan tiles	1.2		
	• Pot tiles	1.2		
2.	Composition of cement	6	6	42
3.	Properties of cork (any 6)	1x6	6	
4.	Advantages of English bond over Flemish bond (any 6)	1x6	6	
5.	Procedure for plastering	6	6	
6.	Effect of dampness (any 6)	1x6	6	
7.	Functions of foundations (any 6)	1x6	6	
<u>PART C</u>				
III(a)	Geological classification.	3	} 8	
III(b)	Physical classification.	3		
	Chemical classification	2		

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(Scoring Indicators)

Revision: 2015		Course Code: 3011		
Course Title: Construction Materials and Engineering				
Qst. No	Scoring Indicator	Split up score	Sub Total	Total
III I(i) b) I(ii)	<u>PART C</u> Preparation of clay Moulding Drying Burning	2 2 2 1	} 7	
IV II(i) a) II(ii)	<u>PART C</u> seasoning definition Natural seasoning Artificial seasoning • Boiling • chemical seasoning • Electrical seasoning • kiln seasoning • Water seasoning	2 1 1 1 1 1	} 8	
IV b)	Properties of cement concrete (any 7)	1x7	7.	
V a) III(a) III(b)	<u>PART C</u> constituents of paints. • Base • Vehicle • Pigments • Colouring • Solvents	2 2 2 1 1	} 8	
V b)	casting based Extrusion based foil and powder based Sheet based	2 2 2 1	} 7	

SCHEME OF VALUATION
(Scoring Indicators)

Revision: 2015		Course Code: 3011		
Course Title: Construction Materials and Engineering				
Qst. No	Scoring Indicator	Split up score	Sub Total	Total
	PART A			
VI VI(i) I(ii)	a) Properties of rubber (any 8)	1x8	8	
	b) <ul style="list-style-type: none"> • Bitumen emulsion. • Blown bitumen • Cut back bitumen 	2 2 1	} 7	
	<ul style="list-style-type: none"> • Plastic bitumen • Straight run bitumen 	1 1	} 2	
II(i) VII	a) causes of dampness (any 8)	1x8	8	
II(ii)	b) Requirement of formwork (any 7)	1x7	7	
III	a) defects in plastering (any 8)	1x8	8	
III	b) <ul style="list-style-type: none"> • Raking shores. • Flying or horizontal shores 	3 3 1	} 7	
	PART C • Dead or vertical shore			
IX IX(i)	a) collapsible steel door	4	} 8	
IX(ii)	Rolling shutter	4		
	b) requirements of good floor (any 7)	1x7	7	
X	a) pile foundation Well foundation	4 4	} 8	
	b) Any two types of windows	3.5x 2		7
				120

QUESTION WISE ANALYSIS

COURSE : Construction Materials and Engineering

VERSION : REVISION 2015

Qn No.	Specific outcome (as per syllabus)	Module	Content Details	Score	Time in Minutes
I					
1.	1.2.1	1	Composition of bricks	2	1
2.	1.3.1	1	lime	2	1
3.	2.1.6	2	Types of glass	2	1
4.	3.2.4	3	DPC	2	1
5	4.1.2	4	Building components	2	1
II					
1.	1.2.2	1	Diff types of tiles	6	6
2.	1.4.1	1	Composition of cement	6	6
3.	2.1.13	2	Properties of coats	6	6
4.	3.1.4	3	English bond	6	6
5.	3.6.1.	3	Plastering	6	6
6.	3.2.1	3	Dampness effects	6	6
7.	4.1.1.	4	Functions of foundations	6	6
III					
a)	1.1.1	1	Classification of stones	8	8
b)	1.2.1	1	Manufacture of Bricks	7	7
IV					
a)	1.8.2	1	Seasoning of timber	8	8
b)	1.7.8	1	Properties of concrete	7	7
V					
a)	2.1.8	2	Constituents of paints	8	8
b)	2.1.5	2	Different aluminium sections	7	7
VI					
a	2.1.4	2	Properties of rubber	8	8
b	2.1.12	2	Forms of Bitumen	7	7
Total Time					

Signature :



Name, Designation & Institution :

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