

105

April 24

Page NO- 14

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
I	Part A			
1.	Seasoning of timber is the process by which moisture content in the timber is reduced to required level. By reducing moisture content, the strength, elasticity and durability properties are developed.	2	10	
2.	The volume of dry sand increases due to absorption of moisture. These volume increase of dry sand is known as bulking of sand. When dry sand comes in contact with moisture, a thin film is formed around the particles, which causes them to get apart from each other.	2		
3.	1. They are generally light in colour. 2. The coatings are generally thick. 3. They give reflective coating. 4. They are less durable than oil paints but are cheaper.	2		
4.	Pre-stressed concrete is a form of concrete where initial compression is given in the concrete before applying the external load so that stress from external loads are counteracted in the desired way during the service period. This initial compression is introduced by high strength steel wire or alloys (called 'tendon') located in the concrete section.	2		
5.	Mullion is a vertical bar between the panels of glass or casements of a window or the panels of a screen. Transom is a transverse horizontal structural beam or bar, or a crosspiece separating a door from a window above it.	2		
II	Part B			
1.	<ul style="list-style-type: none">• It should be free from any cracks, flaws or bends.• It should be regular in shape and size.• It should be sound, hard and durable.• It should be well burnt and should possess uniform colour.• It should give a clear ringing sound when struck with hand or with one another or with light hammer.• It should give an even and compact structure when seen on its broken surface.	6x1=6		

<p>2.</p>	<p>1. Aggregate:</p> <ul style="list-style-type: none"> • Fine aggregate (sand) particle size less than 4.75mm • Coarse aggregate – Particle size more than 4.75mm <p>Fine aggregate (Sand) consists of small angular or rounded grains of silica. Sand is commonly used as the fine aggregate in cement concrete.</p> <p>Functions of sand:</p> <ul style="list-style-type: none"> ❖ It fills the voids existing in the coarse aggregate. ❖ It reduces shrinkage and cracking of concrete. ❖ By varying the proportion of sand concrete can be prepared economically for any required strength <p>Coarse aggregate Functions:</p> <p>Coarse aggregate makes solid and hard mass of concrete with cement and sand.</p> <ul style="list-style-type: none"> ❖ It increases the crushing strength of concrete. ❖ It reduces the cost of concrete, since it occupies major volume. <p>Functions of water:</p> <ul style="list-style-type: none"> ❖ Water is only the ingredient that reacts chemically with cement and thus setting and hardening takes place. ❖ Water acts as a lubricant for the aggregate and makes the concrete workable. ❖ It facilitates the spreading of cement over the fine aggregate. <p><u>Functions of cement</u></p> <ul style="list-style-type: none"> ❖ It fills up voids existing in the fine aggregate and makes the concrete impermeable. ❖ It provides strength to concrete on setting and hardening. ❖ It binds the aggregate into a solid mass by virtue of its setting and hardening properties when mixed with water. 	<p>3 x 2=6</p>	<p>5*6 =30</p>	
<p>3.</p>	<p>Asphalt, black or brown petroleum-like material that has a consistency varying from viscous liquid to glassy solid. It is obtained either as a residue from the distillation of petroleum or from natural deposits.</p> <p>The principal application of asphalt is in road surfacing, which may be done in a variety of ways. Other important applications include canal and reservoir linings, dam facings, and other harbour and sea works;</p>	<p>6</p>		

	<p>asphalt so used may be a thin, sprayed membrane, covered with earth for protection against weathering and mechanical damage, or thicker surfaces, often including riprap (crushed rock). Asphalt is also used for roofs, coatings, floor tilings, soundproofing, waterproofing, and other building-construction elements and in a number of industrial products, such as batteries</p> <p>An asphalt concrete mixture must be designed, produced and placed in order to obtain the following desirable mix properties:</p> <p>Stability</p> <p>Durability</p> <p>Flexibility</p> <p>Fatigue Resistance</p> <p>Skid Resistance</p> <p>Impermeability</p> <p>Workability</p>			
<p>4.</p>	<ul style="list-style-type: none"> • Plastering is used to protect the exposed surface of masonry. However, in pointing only joints are properly filled with mortar. • In plastering work, we use the large amount of materials. However in pointing, we use less amount of 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 (both inside and outside). However, pointing is done only at the outer side of the wall. 	<p>6</p>		
<p>5.</p>	<p>The partition wall should be</p> <ul style="list-style-type: none"> • strong enough to carry its own load. • strong enough to resist impact to which the occupation of the building is likely to subject them. • With the capacity to support suitable decorative surface. • stable and strong enough to support some wall fixtures, wash basins etc. • as light as possible. • as thin as possible. 	<p>6</p>		

6.	<ul style="list-style-type: none"> • Able to act as a sound barrier, especially when it divides two rooms. • fire resistant. <p>Advantages of timber formwork</p> <ul style="list-style-type: none"> ○ Easy handling because it's light weight. ○ Easy to disassemble. ○ Damaged parts can be replaced with new one. ○ Very flexible. <p>Disadvantages of timber formwork</p> <ul style="list-style-type: none"> ○ Can't be used for long. Have limited re-use. Can only be re-used 5 or 6 times. ○ If the timber is dry, it will absorb moisture from wet concrete which could weaken the resultant concrete member. ○ Timber with high moisture content (more than 20 % moisture content), wet concrete will shrink & cup leading to open joints & leakage of grout. <p>Advantages of steel formwork</p> <ul style="list-style-type: none"> ○ Very strong and able to carry heavy load. ○ Easy to be fixed. ○ Uniform size and surface. ○ Can be used for a very long time. <p>Disadvantages of steel formwork</p> <ul style="list-style-type: none"> ○ Limited size or shape. ○ Excessive loss of heat. ○ A very smooth surface will be produced which would give problems for finishing process. 	6		
7.	<p>Based on the purposes of foundation in construction, the main functions of the foundation can be enlisted as below:</p> <ol style="list-style-type: none"> 1. Provide overall lateral stability for the structure 2. Foundation serve the function of providing a level surface for the construction of substructure 3. Load Distribution is carried out evenly 4. The load intensity is reduced to be within the safe bearing capacity of the soil 5. The soil movement effect is resisted and prevented 6. Scouring issues are solved by the construction of foundation 	6*1=6		
III. a	<p>Part C</p> <p>Geological Classification</p> <p>Based on their origin of formation stones are classified into three main groups—Igneous, sedimentary and metamorphic rocks.</p>	15	15 x4 =60	

<p>IV.a</p>	<p><u>Igneous Rocks:</u></p> <p>These rocks are formed by cooling and solidifying of the rock masses from their molten magmatic condition of the material of the earth. Generally igneous rocks are strong and durable. Granite, trap and basalt are the rocks belonging to this category, Granites are formed by slow cooling of the lava under thick cover on the top. Hence they have crystalline surface. The cooling of lava at the top surface of earth results into non-crystalline and glassy texture. Trap and basalt belong to this category.</p> <p><u>Sedimentary Rocks:</u></p> <p>Due to weathering action of water, wind and frost existing rocks disintegrates. The disintegrated material is carried by wind and water; the water being most powerful medium. Flowing water deposits its suspended materials at some points of obstacles to its flow. These deposited layers of materials get consolidated under pressure and by heat. Chemical agents also contribute to the cementing of the deposits. The rocks thus formed are more uniform, fine grained and compact in their nature. They represent a bedded or stratified structure in general. Sand stones, lime stones, mud stones etc. belong to this class of rock.</p> <p><u>Metamorphic Rocks:</u></p> <p>Previously formed igneous and sedimentary rocks under go changes due to metamorphic action of pressure and internal heat. For example due to metamorphic action granite becomes gneisses, trap and basalt change to schist and laterite, lime stone changes to marble, sand stone becomes quartzite and mud stone becomes slate.</p> <p><u>Vicat Apparatus</u></p> <p>The vicat apparatus consists of a frame having a movable rod with a cap at one end and at the other end any one of the following attachment, which are interchangeable:</p> <ul style="list-style-type: none"> • Needle for determining the initial setting time • Needle for determining the final setting time • Plunger for determining the standard consistency <p>Plunger for Standard Consistency</p> <p>It is of polished brass $10 \pm 0.05\text{mm}$ in diameter with a projection at the upper end for insertion into the movable rod. The lower end is flat.</p>	<p>15</p>		
-------------	---	-----------	--	--

Movable rod carries an indicator which moves over a graduated scale attached to the frame (certain models have an additional attachment of dash pot, which facilitates lowering of movable rod slowly).
Graduated scale is 40mm in length and the smallest division of scale is 1mm.

- Vicat Mould

Single mould:

The vicat mould is in the form of a frustum of a cone having an internal diameter of 60 ± 0.5 mm at the top, 70 ± 0.5 mm at the bottom and height 40 ± 0.5 mm.

Split type vicat mould:

The split type vicat mould is used as an alternative to single mould. This mould consists of a split ring having an internal diameter 80 ± 0.1 mm and a height 40 ± 0.5 mm. A non-porous base plate is provided. The split mould is provided with a suitable clamping ring.

Procedure for Standard Consistency of Cement

- Keep the vicat apparatus on a level base (when using vicat apparatus with dashpot, keep the bearing movable rod to its highest position and pin it.) Unscrew the top of the dashpot. Half fill the dashpot with any suitable oil of viscosity and screw the top. Work the plunger a number of times.
- Attach the plunger for determining standard consistency to the movable rod. Work the plunger a number of times.
- Take 400 gm of cement in a pan and a weighed quantity of water in a beaker.
- Prepare a paste with the water added to cement. Start a stopwatch at the time of adding water to cement.
- Keep the vicat mould on a non porous plate and fill the cement paste in it.
- After completely filling the mould, shake it slightly to expel the air. Smooth off the surface of the paste making it level with the top of the moulder. The cement paste thus prepared is the test block.
- Place the test block resting on the non porous plate under the movable rod, bearing the needle.
- Lower the plunger gently to touch the surface of the cement paste and quickly release; (when vicat apparatus with dashpot is used, place the mould filled with cement paste and the non absorbent plate on the base plate of the vicat apparatus. Raise the plunger of the dash pot, bring it in contact with the top cap of the movable bearing rod.
- Remove the pin holding the movable bearing rod to the surface of the cement paste and quickly release by pushing down the

	<p>plunger to sink in to the paste). This operation shall be done immediately after filling the mould.</p> <ul style="list-style-type: none"> • Prepare trial test specimens with varying percentages of water until plunger penetrates to a point 5 to 7mm from the bottom of the vicat mould, which is read on the scale. Express the water required as percentage by weight of the dry cement. 			
V.a	<p>The following are the physical properties of rubber:</p> <ol style="list-style-type: none"> 1. Specific gravity 2. Abrasion resistance 3. Tear resistance 4. Compression set 5. Resilience 6. Elongation 7. Tensile modulus 8. Tensile strength 9. Hardness 	6		
V.b	<p>A. Bitumen is obtained by the partial distillation of crude petroleum. It is also called as mineral tar and is present in asphalt also. It contains 87% carbon, 11% hydrogen and 2% oxygen.</p> <p>B. Veneers are thin slices of wood which are glued on to the surface of a core material for decorative effect or Laminated to each other to create Plywood. Veneers can also be glued together around Moulds to create curved forms'</p> <p>C. Plywood is a 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.</p>	9		
VI. a	<p>A Paint is essentially a coating or covering material applied on metallic or non-metallic surfaces for decorative or protective purposes.</p> <p>1. Aluminum Paints</p> <p>Aluminum paints are made by mixing finely ground aluminum with spirit or oil varnishes. Spirit varnish makes the drying period shorter and oil varnish imparts slow drying facility. So, varnish cane be used according to the requirement. This type of paint is used for painting wood works, metallic surface etc. The layer of paint is hardened by</p>	15		

<p>VII.a</p>	<p>evaporation of spirit or oil. Aluminum paint has many advantages such as, it is waterproof, resistance against electricity, corrosion, weathering, it can be visible in dark and provides good appearance.</p> <p>2. Asbestos Paints</p> <p>Asbestos paint is a special purpose paint which is made of fibrous asbestos. It is used for covering leakage in metal roofs, for patch works, for protecting surfaces from acid gases and steam. Rusting of pouts, flashings, gutters etc. can also be prevented using asbestos paint coating.</p> <p>3.Bituminous paints</p> <p>Bituminous paints are obtained by dissolving tar or asphalt in petroleum or white spirit. They provide black appearance to the surface. Bituminous paints are used for metal structures in under water conditions, iron pipes carrying water. Bituminous paints have good alkali resistant property.</p> <p>4. Silicate Paints</p> <p>Silicate paint is a mixture of silica and resinous substances. Silica gives good adhesion to the paint which will form hard surface after drying. This surface can resist extreme heat with great resistance. Silicate paints never reacts chemically with the metals. So, this type of paint can be used in hot conditions and for metal structures.</p> <p>5. Graphite Paints</p> <p>Graphite paint is made of graphite which is in black color. It is used for painting underground structures like mines etc. Iron structures are coated with graphite paints.</p> <p>TECHNIQUES:</p> <ul style="list-style-type: none"> • Use of damp proof courses • Water proof or damp proof treatments • Integral damp proofing treatment • Cavity walls or hallow walls • Guniting or shot concrete or shotcrete • Pressure grouting or cementation 	<p>15</p>		
---------------------	--	-----------	--	--

1. USE OF DAMP-PROOF COURSES (D.P.C.)

These are layers or membranes of water repellent materials such as bituminous felts, mastic asphalt, plastic sheets, cement concrete, mortar, metal sheets, stones etc. which are interposed in the building structure at all locations wherever water entry is anticipated or suspected. The best location or position of D.P.C. in the case of building without basement lies at plinth level or structures without any plinth level, it should be laid at least 15cm above ground level. The damp proof course is provided horizontally and vertically in floors, walls etc.

2. INTEGRAL DAMP-PROOFING TREATMENTS:

The integral treatment consists of adding certain compounds to the concrete or mortar during the process of mixing, which when used in construction acts as barriers to moisture penetration under different principles

i) Compounds like chalk, talc, fallers earth etc. have mechanical action principle (i.e.,) they fill the pores present in the concrete or mortar and make them dense and water proof

ii) Compounds like denser and water proof sulphates, calcium chlorides etc. work on chemical action principle (i.e.) they react chemically and fill the pores to act as water-resistant

iii) The compounds like soaps, petroleum, oils fatty acids compounds such as sodium ammonium etc. work on the repulsion principle i.e., they are used as admixture in concrete to react with it and become water repellent

3. CAVITY WALLS OR HALLOW WALLS:

A cavity wall consists of two parallel walls or leaves or skins of masonry separated by a continuous air space or cavity. The provision of continuous cavity in the wall per effectively prevent the transmission or percolation of dampness from outer walls or leaf to inner wall or leaf. The following are the advantages of cavity wall.

(i) As there is no contact between outer and inner walls of cavity wall, possibility of moisture penetration is reduced to a minimum.

(ii) A cavity wall prevents the transmission of heat through wall.

(iii) A cavity wall offer good insulation against sound.

	<p>(iv) The cavity wall tends to reduce the nuisance of efflorescence.</p> <p>(v) The cavity wall also provides benefits such as economy, better comfort and hygienic conditions in buildings</p>			
<p>VIII. a</p>	<p><u>English bond</u></p> <ul style="list-style-type: none"> • Headers and stretchers are laid in alternate courses. • Strongest of the types of bonds. • Provides rough appearance. • Absence of vertical joints in the structure. • Special attention is not required for this bond. • Progress of work is more. • Costly, no brick bats are used. • Skilled labor is not required for its construction. • Less mortar is used. <p><u>Flemish bond</u></p> <ul style="list-style-type: none"> • Headers and stretchers are laid alternately in each course. • Comparatively less strong for walls more than 30cm thick. • Provide good appearance. • Partly continuous vertical joints appear in the structure. • Special attention is required for this bond. • Progress of work is less. • Economical, as brick bats are used. • Skilled labor required for its construction. • More mortar is used due to use of bats. 	7		
<p>VIII. b</p>	<p>Advantages of Prestressed Concrete</p> <ul style="list-style-type: none"> • Longer span length increases untroubled floor space and parking facilities. • Thinner slabs, that are important for high rise building as with the same amount of cost, it can construct more slabs than traditional thicker slabs. • As the span length is larger, fewer joints are needed than traditional RC structures. • Because of fewer joints, maintenance cost also becomes reduced during the design life as joints are the major locus of weakness in a concrete building. 	8		

- Long-term Durability.
- Better finishing of placed concrete.
- It requires a smaller amount of construction materials.
- It resists higher stresses than normal RCC structures and is free from cracks.

Disadvantages of Prestressed Concrete

- It requires high strength concrete and high tensile strength steel wires.
- The main disadvantage is construction requires additional special equipment like jacks, anchorage, etc.
- It requires highly skilled workers under skilled supervision.
- Construction cost is little higher than RCC structures.

IX. a

A good stair should provide an easy, quick and safe mode of communication between the various floors of the building. General requirements of good stairs are as mentioned below.

1. LOCATION

It should preferably be located centrally, ensuring sufficient light and ventilation.

2. WIDTH OF STAIR

The width of stairs for public buildings should be 1.8 m and for residential buildings 0.9 m.

3. LENGTH

The flight of the stairs should be restricted to a maximum of 12 and minimum of 3 steps.

4. PITCH OF STAIR

The pitch of long stairs should be made flatter by introducing landing. The slope should not exceed 40° and should not be less than 25° .

5. HEAD ROOM

The distance between the tread and soffit of the flight immediately above it, should not be less than 2.1 to 2.3 m. This much of height is

7

	<p>maintained so that a tall person can use the stairs with some luggage on its head.</p> <p>6. MATERIALS</p> <p>Stairs should be constructed using fire resisting materials. Materials also should have sufficient strength to resist any impact.</p> <p>7. BALUSTRADE</p> <p>All open well stairs should be provided with balustrades, to avoid accidents. In case of wide stairs it should be provided with hand rails on both sides.</p> <p>8. LANDING</p> <p>The width of the landing should not be less than the width of the stair.</p> <p>9. WINDERS</p> <p>These should be avoided and if found necessary, may be provided at lower end of the flight.</p> <p>10. STEP PROPORTIONS</p> <p>The ratio of the going and the rise of a step should be well proportioned to ensure a comfortable access to the stair way.</p> <p>Following empirical rules may be followed.</p> <ul style="list-style-type: none"> • Treads/Goings in cm + 2 (rise in cm) = 60 • Treads/Goings in cm x (rise in cm) = 400 to 450 appx. • Treads/Goings in cm + (rise in cm) = 40 to 45 appx. • Standard sizes: Tread 30 cm, Rise 14 cm 			
IX. b	<p>The main objectives of the foundation are to:</p> <ul style="list-style-type: none"> • To distribute the weight of the structure over large area so as to avoid over loading of the soil beneath • Load the sub- stratum evenly and thus prevent unequal settlement. • To provide a level surface for building operations. 	4 x2=8		

- To take the structure deep into the ground and thus increase its stability, and prevent overturning.

X.a

1. Fixed Windows

Fixed windows are fixed to the wall without any closing or opening operation. In general, they are provided to transmit the light into the room. Fully glazed shutters are fixed to the window frame. The shutters provided are generally weather proof.

2. Sliding Windows

In this case, window shutters are movable in the frame. The movement may be horizontal or vertical based on our requirement. The movement of shutters is done by the provision of roller bearings. Generally, this type of window is provided in buses, bank counters, shops etc.

3. Pivoted Windows

In this type of windows, pivots are provided to window frames. Pivot is a shaft which helps to oscillate the shutter. No rebates are required for the frame. The swinging may either horizontal or vertical based on the position of pivots.

4. Louvered Windows

Louvered windows are similar to louvered doors which are provided for the ventilation without any outside vision. The louvers may be made of wood, glass or metal. Louvers can also be folded by provision of cord over pulleys. We can maintain the slope of louvers by tilting cord and lifting cord. Recommended angle of inclination of louvers is about 45°. The sloping of louvers is downward to the outside to run-off the rain water. Generally, they are provided for bathrooms, toilets and privacy places etc.

5. Casement Windows

Casement windows are the widely used and common windows nowadays. The shutters are attached to frame and these can be opened and closed like door shutters. Rebates are provided to the frame to receive the shutters. The panels of shutters may be single or multiple. Sometimes wired mesh is provided to stop entering of fly's.

15

6. Corner Windows

As in the name itself corner windows are provided at the corners of room. That means corner windows has two faces in perpendicular directions. By providing this type of windows, light or air can be entered into room in two different directions. To provide this type of window special lintel is provided in the wall. Corner windows will give aesthetic appearance to the building.

7. Bay Windows

Bay windows are projected windows form wall which are provided to increase the area of opening, which enables more ventilation and light form outside. The projection of bay windows are of different shapes. It may be triangular or rectangular or polygonal etc. They give beautiful appearance to the structure.

8. Dormer Windows

Dormer windows are provided for sloped roofs. These are projected from the sloping surface as shown in below image. They provide ventilation as well as lighting to the room. They also enhance aesthetic sense of room.

9. Clerestory Windows

If the rooms in a building are of different ceiling heights, clerestory windows are provided for the room which has greater ceiling height than the other rooms. The shutters able to swing with the help of cord over pulleys. These also enhances the beauty of building.

10. Lantern Windows

Lantern windows are provided for over the flat roofs. The main purpose of this window is to provide the more light and air circulation to the interior rooms. Generally, they are projected from the roof surface so, we can close the roof surface when we required.