SUMMER – 15 EXAMINATIONS

Subject Code: 17209 **Model Answer- Construction Materials**

Important Instruction to Examiners:-

1) The answers should be examined by key words & not as word to word as given in the model answers scheme.

2) The model answers & answers written by the candidate may vary but the examiner may try to access the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more importance.

4) While assessing figures, examiners, may give credit for principle components indicated in the figure.

The figures drawn by candidate & model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credit may be given step wise for numerical problems. In some cases, the assumed contact values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.

7) For programming language papers, credit may be given to any other programme based on equivalent concept.

Important notes to examiner

Q1.	Attempt Any Ten	20 M
1.	**State the role of Civil Engineering in Human Life.** 1. Civil Engineer manages all activities related to construction to make the construction work smooth. 2. Civil Engineer surveys the land or location of project before starting the construction work. 3. Civil Engineer designs the structural members of the Building to make the building strong.	**1M each for any Two points.**
2.	**State any two purpose of valuation**. 1. To know the exact value of the property. 2. To sale or purchase the property its valuation should be known. 3. For purpose of loan on property its valuation should be known. ***Note: -Student may write any other purpose of valuation and accordingly marks should be given by the examiner.***	**1M each any Two points.**
3.	**What is quarrying of Stones? State any two methods of quarrying.** The process of taking out stones from natural rock beds is known as quarrying of stones. Methods of Quarrying of Stones: - a) Digging b) Heating c) Wedging d) Blasting.	**1M ½ M each for any Two Methods**
4.	**State any Two Defects occur in timber.** 1. Defect due to conversion. 2. Defect due to fungi. 3. Defect due to insects. 4. Defect due to natural forces.	**1M each any Two points.**
5.	**State various types of Bituminous material used in Civil Engineering Work.** 1. Bitumen Emulsion 2. Blown Bitumen 3. Cut Back Bitumen. 4. Plastic Bitumen 5. Straight Run Bitumen.	**1M each for any Two Points**
6.	**State Detail Classification of Cement.** 1. Acid Resisting Cement 2. Colored Cement 3. Sulphate Resisting Cement 4. White Cement 5. Rapid Hardening Cement.	**½ M each for any four types**
7.	**State any two timber based product used in Civil Engineering.** 1. Veneers 2. Plywood 3. Fiberboards 4. Saw Dust 5. Impreg Timber 6. Compreg Timber.	**1M each for any Two points.**
8.	**Mention different types of Fibers** 1. Carbon fibers 2. Glass fibers 3. Plastic fibers 4. Asbestos fibers 5. Steel fibers 6. Jute fibers 7. Coir fibers	**½ M each for any Four types.**
9.	**Mention any two waterproofing brands available in the market.** **1.** Ridex AP **2.** Ridex weather safe **3.**Water repellent **4.** Ridex seal **5.** Wall plast **6** Dr. Fixit	**1M for any Two points**
10.	**State any two use of Termite proofing Material.** Termite proofing materials: **i. EPS sandwich panel** **Uses:** **a.** Interior and exterior partition on steel or concrete **b.** For various buildings like banks, offices,hospitals, schools, hotels, etc.	**1M each for any Two uses.**

	ii. Termite resistance wood plastic composite floor **Uses:** **a.** Used for outside walls **b.** Used for decking board **iii. Taixi wood** **Uses:** **a.** Used in offices, hotels, public buildings, commercial premises **iv. Termotar:** **Uses :** **a.**Termortar used in brickwork construction	
k)	**State Constituents of Good Quality Brick** **1.** Alumina **2.** Silica **3.** Lime **4.** Oxides of Iron **5.** Magnesia.	**½ M each for any Four Points.**
l)	**Mention Chemical and Mechanical Properties of Blast Furnaces Slag** **Chemical Property of Blast Furnace Slag:-** a) It is mildly alkaline having pH value from 8 to 10. b) It contains small amount of sulphur but it does not pose a corrosion rick to steel piling or steel embedded in concrete made with blast furnace slag. **Mechanical Property of Blast Furnace Slag: -** 1) As the blast furnace slag has good abrasion resistance, good soundness characteristic it is used as an aggregate material. 2) It has high insulating value and high water absorption value.	**½ M each** **½ M each**
Q2.	**Attempt any Four**	**16 M**
1.	**What do you mean by Eco Friendly Building Materials? State any two properties of it.** Eco-friendly means earth-friendly or not harmful to the environment. This term most commonly refers to products that contribute to green living or practices that help conserve resources like water and energy. Eco-friendly products also prevent contributions to air, water and land pollution **Properties of Eco-Friendly Material** 1. It is bio-degradable. 2. It is renewable source. 3. It is reused & recycled. 4. It increases durability & life span of living bodies. 5. It aids energy efficiency in building. 6. It reduces air pollution, land pollution & water pollution. 7. It is locally available.	**2M** **1M each for any Two points**
2.	**Explain the meaning of Retarding and Accelerating Admixture with one example each.** **Retarding Admixtures: -**is to slow down the chemical process of hydration so that concrete remains plastic and workable for a longer time than concrete without retarder. **Example: -**Gypsum, Calcium Sulphate, Lingo Sulphonic Acids. **Accelerating Admixtures: -** these admixtures accelerate the rate of hydration reaction and hence accelerate the rate of development of strength in concrete. **Example: -** Calcium Chloride, Silicates, Soluble Carbonates.	**1M** **1M** **1M** **1M**

3. **What is seasoning of Timber? Explain Natural Seasoning method.**

Seasoning of Timber: - — **½ M each**

1. When a tress is newly felled it contains about 50% or more of its own dry weight as water.
2. This water is in the form of sap and moisture.
3. The water is to be removed before timber can be used for any Engineering purpose.
4. The process of drying of timber is known as seasoning of timber.

Natural Seasoning : - — **½ M each for any four Points**

1. In this method seasoning of timber is carried out by natural air and hence it is also called as air seasoning. The timber is cut down and sawn into suitable section of planks.
2. The timbers are placed in stack horizontally or vertically and the place where it is stacked is cleared and levelled for good drainage.
3. The platform of stack if made slightly higher about 300mm than ground level, the timber pieces are sorted out accordingly to the length and thickness. Then they are arranged in layers one above the other having same thickness.
4. Each layer is separated by spacers of sound dry wood placed in vertical alignment.
5. The length of stack is equal to length of timber and the width is restricted to 1.5m to 3.0m.
6. The stack should be protected from fast blowing wind, rain and heat and should be covered by roof of suitable material.

d **Give Physical Classification of Stone with example.**

Physical Classification of Stone: -

1. **Stratified: -** These rocks have many strata. They can split along their cleavage planes into thin layers. These are dense and durable. Sedimentary rocks belong to this category. — **1M**
   Example: - Slates, Compact limestone.
2. **Unstratified:-** These rocks have no strata but have grains which are granular crystalline. — **1M**
   Example: - Sandstone, Limestone.
3. **Foliated: -** These rocks have tendency to split along a definite direction only. The direction need not to be parallel to each other. — **2M**
   Example: - Granite, Quartzite, Marble.

e **Draw Particle size and IS classification of Soil.**

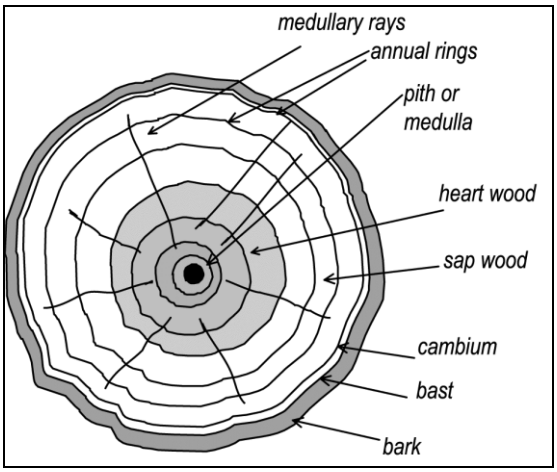
Particle Size: - — **2M**

a) Clay: - less than 2 micron. b) Slit: - 2 micron to 75 micron
c) Sand:- 75 micron to 4.75 micron d) Gravel: - 4.75 micron to 80mm
e) Pebbles: - 80mm to 300mm f) Boulders: - More than 300mm

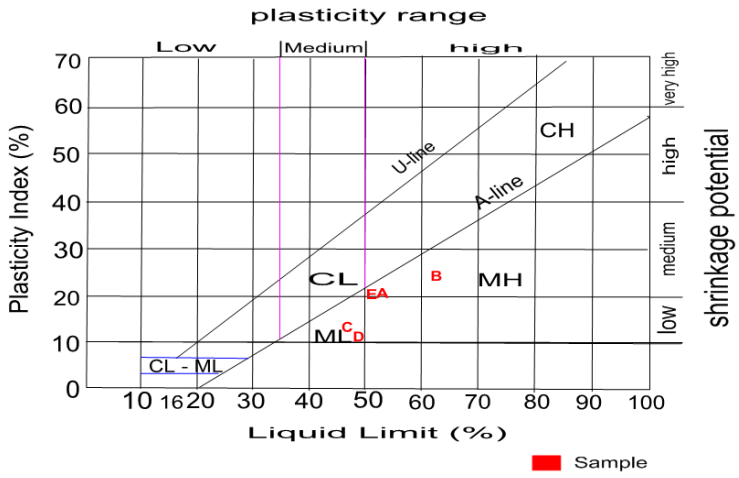
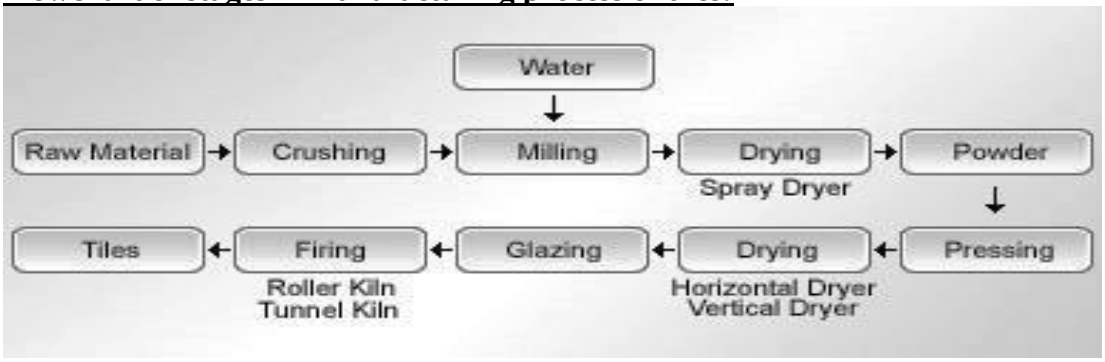
IS Classification of Soil — **2M**

Soil		
Coarse Grained Soil:	Gravels	Clean Gravel
		Gravel with fines
	Sand	Clean Sand
		Sand with fines
Fine Grained Soil	Silts	Low Compressibility
		Medium Compressibility
		High Compressibility
	Clay	Low Compressibility

			Medium Compressibility	
			High Compressibility	
	Highly Grained Soil			

f	**Draw Cross Section of trunk of timber. Give any four engineering properties of timber.**  Cross Section of Trunk of Timber **Properties of Timber** **1**. Colour- It should be uniform. **2.** Odor- It should be pleasant when cut freshly. **3.** Soundness- A clear ringing sound when struck indicates the timber is good. **4.** Texture- Texture of good timber is fine and even. **5.** Density- Higher the density, stronger is the timber. **6.** Toughness- Timber should be capable of resisting shock loads. **7.** Abrasion **8.** Strength **9.** Fire resistance	**2M** **½ M for any four points**

Q .NO	SOLUTION	MARKS
Q 03.	**Attempt ANY FOUR of following: (04 x 04 = 16)**	**16**
a)	**State the classification and any two properties of lime.**	**04**
	Classification of lime: **Classification by strength:** 1. Non-hydraulic limes 2. Semi-hydraulic limes 3. Eminently Hydraulic limes **Classification based on composition:** 1. Lean or Poor lime 2. Hydraulic Lime 3. Pure OR Rich OR Fat Lime. 4. Dolomite lime **Properties of lime:** 1. High calcium or fat lime when exposed to air it absorbs CO_2 and reform into $CaCO_3$ hence it slakes rapidly and is strongest. 2. Lean or poor lime slakes slowly and is difficult to work with. 3. Hydraulic lime slakes slowly with water and at the same time possesses hydraulic property of setting under water. 4. Dolomite lime is hydrated under pressure for maximum utility.	**01** **01** **1 each Any 2**
b)	**Enlist various tests conducted on bitumen and explain any one of them.**	**04**
	Various tests conducted on bitumen: 1. **Consistency test-** Viscometer/Engler Test/Penetration test/Softening point. 2. **Heat test**-Flash & Fire test/Loss on heat/Distillation/Water content test. 3. **Solubility and composition** 4. **Ductility** 5. **Specific gravity-** Pycnometer/Balancemethod. 6. **Adhesion.** **Flash and Fire point test:** Flash point is the lowest temperature at which the vapour of the substance can be ignited in air by a flame under specific conditions of test. The substance itself does not continue to burn. The sample is filled in an open metal cup suspended in air. It is heated at a uniform rate and an open flame is passed over its surface to determine the temperature at which the volatile vapours are given off and catch fire. The significance of this test is that in practice the bitumen should be heated 10^0c below flash point from safety point of view.	**1 each Any 2** **2 for explanation**
c)	**Explain plasticity chart of soil.**	**04**
	Plasticity Chart—A plasticity chart is used to differentiate the plasticity and organic characteristics of the fine-grained soils based on liquid limit (LL) and plasticity index (PI) of the soils. It is the graph plotted against Liquid limit Vs Plasticity Index. this chart is useful for the classification of soil based on Liquid limit and Plasticity Index	**02 Marks**

		**02 Marks**
d)	**State importance of special types of bricks and its applications.**	**04**
	Importance of special types of bricks and its applications: 1. Acid resistant brick: They have better acid resistance. *Application:* Used in construction of chemical plants. 2. Engineering bricks: They are less porous and absorb less water, sufficient resistance against impact and abrasion. *Application:* Used for paving purpose. 3. Silica bricks: They are lighter in weight. *Application:*Used for load bearing walls or partition walls. 4. Refractory bricks: They have sufficient resistance against heat, acid attack. *Application:* Used for metallurgical furnaces. 5. Sand lime bricks: Very strong and hard bricks than clay bricks having uniform colour and texture with sharp edges. *Application:* Very suitable for ornamental work. 6. Blue bricks: Very hard and dense. *Application:* Used for heavy engineering works like bridges etc.	**1 each (Any 4)**
e)	**Draw flowchart of stages in manufacturing process of tiles. Mention characteristics of good tiles.**	**04**
	Flowchart of stages in manufacturing process of tiles:  **Characteristics of good tiles:** 1. Uniform texture. 2. Accurate size and shape. 3. Free from defects like cracks, impurities, etc. 4. High durability. 5. Water absorption less than 15% 6. Resistant to atmosphere and dampness.	

f)	**State <u>any four</u> characteristics of good brick.**	**04**
	<u>Characteristics of good brick:</u> 1. The brick should have uniform size and plane, rectangular surfaces with parallel sides and sharp straight edges. 2. The brick should have a uniform deep red or cherry colour. 3. The brick should have uniform texture. 4. The surface should not be too smooth to cause slipping of mortar. 5. Water absorption should not be more than 20% of its dry weight. 6. Crushing strength should not be less than $10N/mm^2$. 7. The brick should be so hard that when scratched by a finger nail no impression is made. 8. When two bricks are struck together, a metallic sound should be produced.	**1 each** **Any 4**
Q 04.	**Attempt <u>ANY FOUR</u> of following: (04 x 04 = 16)**	**16**
a)	**What is artificial timber? State important features of rubber wood.**	**04**
	<u>Artificial timber:</u> The timber which is converted in a factory by some mechanical processes is termed as 'Artificial timber'. And such timber possesses desired shape, appearance, strength and durability. It is a wood substitute made from solid waste like fly ash, silica, bituminous, and other bio-degradable material. **<u>Important features of rubber wood:</u>** 1. Rubber wood is a light hardwood. 2. Rubberwood has very little tendency to warp or crack. 3. Rubberwood has very little shrinkage, making it one of the more stable construction materials available for furniture manufacturing. 4. Rubber wood-Eco Friendly. 5. It is a moderately hard and 'light to moderately heavy' timber with density ranging from 435 to 626 kg/m3 at 12% moisture content.	**1** **1 each** **ANY 3**
b)	**State <u>any two</u> properties and enlist <u>any four</u> types of glass.**	**04**
	<u>Properties of glass:</u> 1. Chemical composition. 2. Viscosity. 3. Thermal conductivity. 4. Coefficient of thermal expansion. 5. Density. 6. Refractive index. 7. Electrical conductivity. 8. Optical properties. 9. Chemical durability. **<u>Types of glass:</u>** 1. Soda lime glass/ Soda ash/Soda glass. 2. Lead glass/ Flint glass. 3. Boro-silicate Glass. 4. Sheet glass 5. Plate glass 6. Tempered glass 7. Wired glass 8. Obscured glass- Frosted/Rolled/Ribbed glass. 9. Laminated glass/ Safety glass. 10. Heat absorbing glass. 11. Ground glass.	**1 each** **Any Two** **½ each** **Any Four**

	12. Block glass. 13. Opal glass. 14. Enamel glass. 15. Optical glass.	
c)	**Explain various stages in wet process of manufacturing of cement.**	**04**
	Various stages in wet process of manufacturing of cement: The manufacturing of cement by wet process can be divided into three stages. <u>Stage-I Mixing of raw materials:</u> In this stage, 10% of chalk and 30% of clay which contains some sand, iron oxide, magnesia, etc. are crushed, grounded and mixed uniformly. Generally the ingredients are crushed in a crushing mill and carried by water into large tanks where it is allowed to settle for weeks. The water is then taken out and the slurry is then dug out and dried in an oven. <u>Stage-II Burning:</u> Burning of the above dried slurry is carried out in a rotary kiln. Kiln rotates at a rate of 1RPM about its longitudinal axis. The slurry is injected the upper end whereas the hot gasses are forced through the lower end of the kiln. As the slurry moves down nodules are formed, which after gets converted into clinkers. The cooled clinkers are collected into containers of suitable size. <u>Stage-III Grinding:</u> In this process, the clinkers are ground to very fine powder in ball mills and tube mills. The powder is then spread over a dry floor for some days for air slacking and then 5% Gypsum is added to improve the quality of cement. The finely ground cement is stored in silos. It is then weighed and packed in bags of 50kg by weight.	**1½** **1½** **1**
d)	**State types any two uses of pre-cast concrete products.**	**04**
	<u>Types of pre-cast concrete products:</u> 1. Structural products 2. Agricultural Products 3. Retaining wall, residential retaining walls, modular block systems, etc. 4. Sanitary and Stormwater management products. 5. Precast water and wastewater products. **Uses of pre-cast concrete products:** 1. Structural use of precast concrete includes foundations, beams, floors, walls, and other structural components. 2. Agricultural Products like cattle feed bunks, cattle grid, agricultural fencing, watering trough, feed troughs, slurry channels, and more. 3. Sanitary and Storm water management products include detention vaults, catch basins, and manholes. 4. Precast water and wastewater products include: aeration systems, dosing tanks, dry wells, grease interceptors, sand-oil/oil-water interceptors, septic tanks and other water & wastewater products.	**1 Each (Any 2)** **1 Each (Any 2)**
e)	**State two merits and two demerits of glass cladding.**	**04**
	<u>Merits of glass cladding:</u> 1. Its use fulfills the architectural view. 2. Glass cladding in building fulfill functional requirement of lighting. 3. Glass is bad conductor of heat; it saves energy in air conditioning of building.	**1 Each (Any 2)**

<table>
<tr><td></td><td><u>Demerits of glass cladding:</u>
1. Unsafe for earthquake proven area.
2. Use of glass also enhances the cost of security.
3. As glass is very costly material, it may increase the budgeted cost of construction work.</td><td>1 Each
(Any 2)</td></tr>
<tr><td>f)</td><td>State properties of fine and coarse aggregates.</td><td>04</td></tr>
<tr><td></td><td>
<table>
<tr><th rowspan="2">Sr. No.</th><th rowspan="2">Tests</th><th colspan="2">Results</th></tr>
<tr><th>Fine Aggregate</th><th>Coarse Aggregate</th></tr>
<tr><td>1.</td><td>Aggregate Impact Test</td><td></td><td>20.24%</td></tr>
<tr><td>2.</td><td>Los Angeles Test</td><td colspan="2">17.19%</td></tr>
<tr><td>3.</td><td>Specific Gravity</td><td>2.73</td><td>2.87</td></tr>
<tr><td>4.</td><td>Water Absorption</td><td>1.29%</td><td>1.895%</td></tr>
<tr><td>5.</td><td>Bulk Density</td><td>1.657 gm/cc</td><td>1.420 gm/cc (10mm),
1.455 gm/cc (20 mm)</td></tr>
<tr><td>6.</td><td>Flakiness Index</td><td colspan="2">9.41%</td></tr>
<tr><td>7.</td><td>Elongation Index</td><td colspan="2">12.80%</td></tr>
</table>
</td><td>1Mark for each any Four</td></tr>
</table>

Q .NO	SOLUTION	MARKS
Q.5)	**Attempt Any <u>Four</u> of the following:**	**16M**
a)	**State any two properties and two uses of Jute.**	**4M**
Ans.	**Properties:** 1. Jute fibre is 100% bio-degradable and recyclable and thus environmentally friendly 2. Jute is a natural fibre with golden and silky shine and hence called the golden fibre. 3. It helps to make best quality industrial yarn, fabric, net and sacks. **Uses:** 1. Jute is used chiefly to make cloth for wrapping bales of raw cotton and to make sacks and coarse cloth. 2. The fibres are also woven into curtains, chair coverings, carpets, area rugs, hessian cloth, and backing for linoleum. 3. Sacking, a fabric made of heavy jute fibres, has its use in the name.	**1M each for any two** **1M each for any two**
b)	**State two properties and two uses of Epoxy.**	**4M**
Ans.	**Properties:** 1. Increased excellent adhesion, chemical and heat resistance. 2. High temperature resistance. 3. Good electrical insulating properties and high thermal insulation. **Uses:** 1. In paints and powder coatings for metal surfaces. 2. As adhesives for wood, metals, glass, stones and plastics. 3. In industrial fooling.	**1M each for any two** **1M each for any two**
c)	**What do you mean by geo-synthetic materials? Mention application of it.**	**4M**
Ans. .	**Geo-synthetic materials:** • Geo-synthetics are man-made materials used to improve soil conditions. 'Geo' means earth or soil and synthetic means man-made • They are made petro- chemical based polymers (plastics) that are biologically inert and do not decompose from bacterial or fungal action However they may be damaged by petro chemicals and susceptibility to ultra-violet light **Application:** 1. To improve level grade soil situations such as roads, valleys, laneways 2. To improve sloped-grade situations such as banks, hill sides. 3. Prevent soil movement (piping), while letting water moved through the materials.	**2M** **1M each for any two**
d)	**State various thermal insulating materials. State any two properties of Insulating material.**	**4M**
Ans.	**Various thermal insulating materials:** 1. Rock Wool 2. Slag wool 3. Fibre board 4. Flexible Blankets **Properties of insulating material:** 1. Pores: Most of the common insulating materials are porous in structure. The entrapped air or any other gas within the pores decreases the thermal conductivity of the material. A large Number of pores are preferred to a few large ones because,	**2M (each 1/2 Mark)**

	if the pores are large, the convection currents may be set causing heat transfer. **2.** Presence of Moisture: with the increase in moisture content, the coefficient of thermal conductivity rises greatly. **3.** They should be Bio-resistant and dry. **4.** They should be chemical- resistant and fire proof.	**1M each for any two**
e)	**State properties and classification of damp proofing materials.**	**4M**
Ans.	**Properties of damp proofing materials:** 1. It should be water proof. 2. It should withstand temperature variations and prevent formation of cracks 3. It should get easily mixed with cement, sand and aggregates to form a homogeneous paste. **Classification of Damp proofing : -** **1.** Membrane Damp Proofing **2.** Integral Damp proofing Surface Treatment. **3.** Guniting Short Concrete/Shotcrete. **4.** Cementation or Pressure Grouting	**1M each for any two** **1M each for any two**
f)	**Explain the method by which water proofing of existing old slab can be done.**	
Ans.	**Providing heavy-duty waterproofing coating using Dr. Fixit new coat:** • Ensure complete surface preparation prior to application & maintain a suitable slope for water drainage • Wires brush the surface to remove loose particles & laitence. Wash with clean water • Ensure complete crack-filling & reinstate damaged portions with PMM as recommended • Allow the repaired surface to cure for 24 hrs. Post which wet the surface to a SSD condition • Brush apply 1 primer coat of Dr. Fixit Prime seal & allow to dry for 4 hours • Dr. Fixit Prime seal to be diluted with 50% water (%by Volume of Dr. Fixit Prime seal) • Brush Apply 1 Coat of Dr. Fixit New coat Over the primed surface • Overlay a open-woven fiber glass mesh, 40 GSM of size 2mm x 2 mm while the 1st Coat is tacky & Allow to dry for 4 hrs • Apply More 2 Coats of Dr. Fixit New coat In a span of 4 Hrs at right angles to the previous coat • Air cure for 7 days prior to complete functional usage	**4M**
Q.6)	**Attempt any <u>four</u> of the following:**	**16M**
a)	**Define Mortar. State any two properties of good mortar.**	**4M**
Ans.	**Mortar:** when some binding materials such as cement or lime is mixed with inert material such as sand, surkhi or cinder and lubricating material such as water is added to it, a paste is formed which is plastic in nature, this paste is known as mortar. **Properties of good mortar:** 1. Mortar must have sufficient strength. 2. It should durable. 3. It should have sufficient workability.	**2M** **1M each for any two**

b)	**State constituents and any two properties of POP.**	**4M**
Ans.	**Constituents of POP:** • It consists of calcium sulfate. It is chemically $CaSO_4.1/2H_2O$. It is obtained by calcining gypsum at 120ºC by Removing3/4 of water of crystallization. $CaSO_4 \cdot 2H_20 \rightarrow CaSO_4 \cdot ½ H_20 + 1 \cdot ½ H_20$ • The hardening of plaster of Paris is a hydration reaction shown above, thus its setting is due to formation of a crystalline hydrate. **Properties of P.O.P: -** **1.** It is light in weight. **2.** It is fire resistant and does not allow heat to pass easily. **3.** It shows good adhesion to fibrous material. **4.** It is not affected by bacteria. **5.** It sets with negligible shrinkage on drying.	**2M** **1M each for any two**
c) **Ans.**	**State types and any two properties of good paint.** **Types good paint:** 1. Oil paint 2. Water paint 3. Cement paint 4. Plastic paint **Properties of good paint:** 1. It should have high hiding power to hide the surface below. 2. It should be able to resist the atmospheric conditions to which it is exposed. 3. The film produced by the paint most washable.	**4M** **2M (each 1/2 Mark)** **2M (each) (any two)**
d) **Ans.**	**What is rice husk? State its importance in construction.** **Rice Husk: -** The outer most layer of paddy grain is called as rice husk. It is separated from brown rice in rice mill. It has high silica content. Rice Husk is highly resistant to moisture penetration and fungal decomposition. **Importance of Rice Husk in construction:** 1. The ash obtained after burning of rice husk has pozzolonic properties. Hence, it can be used as an alternative to cement and concrete in construction work. 2. Rice husk ash is used in the manufacture of refractory bricks because of its insulating properties. 3. RHA is used during the production of high quality flat steel. 4. Improving residual soil properties by mixing RHA and cement in suitable proportions as stabilizing agents.	**4M** **2M** **2M (each) (any two)**
e) **Ans.**	**State any two properties and any two uses of fly ash.** **Properties of fly ash:** 1. Fly ash contains silicon dioxide (SiO_2), Al_2O_3, Fe_2O_3, calcium oxide (CaO), some toxic elements such as arsenic, boron, manganese, mercury etc. 2. Fly ash together with bottom- ash is a non hazardous material 3. It is heterogeneous material. **Uses of fly ash:** 1. It is used a geo polymers 2. It is used as substitute for aggregate in brick production. 3. It is used in concrete production, as a substitute for Portland cement and sand. 4. It used land reclamation.	**4M** **2M** **2M** **1M each any Two**

f)	**What is construction waste? How it is applicable in Civil Engineering?**	
Ans.	**Construction waste:** It consists of unwanted materials produced directly or incidentally by construction or industries. These include building materials such as insulation, nails, electrical wiring and waste originating from the site preparation like dredging materials, tree stumps and rubble.	**2M**
	Applications of construction waste in Civil Engineering: 1. Waste generated from construction should be recycled and reused. 2. The pieces of bricks, hardened mortar and concrete can be used in manufacturing of concrete block. 3. Waste from the timber such as saw dust can be used for making light weight concrete. 4. Metal pieces can be recycled and send to metal industries for manufacturing of new product. 5. Plastic pieces can be recycled and send to plastic industries for manufacturing of new product.	**1M each for any two**