WINTER -2016 EXAMINATION

Subject code: 17209 Model Answer-Construction Materials Page No: 01/13

Important Instructions to examiners:

1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language error such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and communication skill).

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

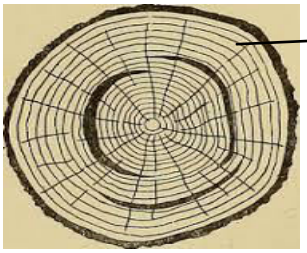
5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.

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

	Question and Model Answers	Marks
Q.1	**Attempt any TEN of the following**	**20**
a)	**Enlist any four basic areas of civil engineering.** 1) Transportation 2) Airports 3) Harbours 4) Irrigation 5) Buildings (Infrastructure) 6) Public Health	**½ M each**
b)	**State any two application of construction management.** **1)** Planning of Construction Activity (CPM) **2)** Use of construction machinery & equipments **3)** Proper management of labour & material **4)** To estimate project duration	**1M each**
c)	**Distinguish between stone and rock** Stone – Natural hard substance formed from minerals & earth material from rock • Stone is used in construction of almost all the structure. • Stones are derived from rocks Rock – Portion of earth's crust having no definite shape & structure. • They have definite chemical composition. • Types of rocks – Granite, Basalt, trap marble etc.	**1M each point**

d)	**State any two properties and uses of bitumen.** **Bitumen – Properties-** - It is adhesive property not affected by air water – a chemical compound of carbon hydrogen - Non crystalline solid - Viscous material **Uses** – Used in damp proofing, paining timber - Can be used an adhesive in road work - Can be used as roof coverings - Used in bitumen emulsion.	**½ M each** **½ M each**
e)	**State constituents of good quality brick.** Constituents of brick - Clay, water - Clay – silica, aluminium, lime etc iron oxide - Adhesive material like – fly ash, rice husk, sandy loam, basalt stone dust.	**1M each**
f)	**Give standard dimensions of :** **i. Conventional Brick** $9"X4\frac{1}{2}"X3"$ **ii. Modular Brick / Standard Brick** $(19X9X9)cm$ & $(19X9X4)cm$	**1M** **1M**
g)	**State any four different types of cement.** Type of Cements – Portland Cements - Rapid hardening cement - High aluminium cement - Super sulphate cement - Sulphate resisting cement - Portland slag cement - Low head cement - Portland pozzolana cement - Quick setting cement - Masonary cement - White & coloured cement - Air entraining cement - Calcium chloride cement - Water repellant cement - Water proof cement - Special cement	**½ M each**

h)	**Write any two advantages of pre-cast block.** 1) Quality 2) Durable 3) Correct size & shape 4) Saves mortar **5)** Light weight (if required)	**1M each**
i)	**Mention any two water proofing material brands available in market.** 1) Bitumen felts 2) Plastic sheeting 3) Mastic asphalt 4) Tar 5) Sika **6)** Dr. Fixit **7)** Fosrock	**1M each**
j)	**What is coir?** Coir – It is obtained from coconut tree. It is natural material. It is used in pressboard & for cooling purpose.	**2M**
k)	**Enlist any four different types of paint.** Type of paints – i) Aluminium paint ii) Anticorrosive paints iii) Asbestos paints iv) Bitu minous paints v) Cellulose paints vi) Cement paints vii) Emulsion paints viii) Enamel paints ix) Oil paints x) plastic paints xi) silicate paints xii) synthetic rubber paints	**½ M each**
l)	**Write any two situations where lime mortar can be used.** - Lightly loaded super structure - Plastering - Pointing - Can be used as mortar -	**1M each**
m)	**Write any two properties of blast furnace slag** Properties of blast furnace slag - Fire resistant, - Strong, - Durable - Corrosion resistant.	**1M each**
n)	**Define** **i. Brick husk** – It is obtained from rice for manufacturing bricks. It is also used for making partial boards. Also used in low cost sandcrete blocks **ii. Blast furnace slag** – It is waste material obtained from furnaces. It is just similar to fly ash.	**1M** **1M**

Q.2	Attempt any FOUR of the following	16M
a)	**Write any four criteria for selection of construction material.** Selection of construction material - Life i.e. durability - Quality - Appearance - Cost - Resistant to climate change - Strength - Resistance of water - Should have specific properties - Applicable level - Serviceability	**1M each**
b)	**Explain role of civil engineer in construction management** Role of Civil Engineer in constituent management. 1) Matching the limitations of funds with total requirements 2) Modify & improve the methods of planning, design & execution. 3) To look after environmental impact. 4) To use maximum local material, labour 5) Quality construction 6) Best selection of material 7) Safety at the site 8) Welfare of labour of staff 9) To work out financing system	**1M each (Any four)**
c)	**Enlist any four defects in timber.** **Shakes** – Separation in wood between rings Hart Shake Cup shake Star shake  - **Rind gall**- due to swelling caused by the growth of layers of sapwood over sounds after the branch have been cut off in an irregular manner. - **Knots** – these are bases of twinges of branches buried by cambial activity of the mother branch din, small, medium & large knot. - **End splits** – Caused by greater evaporation of sap at the end grains of log. - **Twisted fibres** – Caused by wind constantly turning the young tree truak in one direction - **Upsets** – Caused by crushing of fibres - **Foxiness** – decay in the form of yellow & red tinge or discoloration of over matured trees. - **Rupture** - caused by injury or impact.	**1M each**

d)	**Enlist types of bituminous material used in construction and explain any one.** Types of bitumen material used in construction 1) Bitumen emulsion, blown bitumen, cutback bitumen, plastic bitumen, straight run bitumen, natural bitumen, petroleum bitumen. 2) i) **Bitumen emulsion** – liquid product in an aqueous solution. It is in very finely divided state. ii) **Blown bitumen** – Obtained by passing air under pressure at higher temperature iii) **Cut back bitumen** – Obtained by fluxing asphalt or bitumen in pressure of some suitable liquid distillates of coal tar iv) **Plastic bitumen** – consist of bitumen, thinner & suitable inert filler. v) **Straight run bitumen** – distilled bitumen to definite viscosity or penetration without further treatment. vi) **Natural bitumen**– Occurrence rarely in natural state. vii) **Petroleum bitumen** - crude petroleum & its resinous residues.	**2M** **2M**
e)	**State constituent material in brick earth.** Constituent materials in bricks earth- - Silica – 50 to 60%, Alumina – 20 – 30 %, Lime – 10%, -Magnesia - <1 %, Ferric oxide - < 7%, Alkalis - < 10% CO_2 , Sulphur trioxide water – very small %	**½ M each**
f)	**Enlist any four field test on cement.** Field test on cement - Colour - Experience coolness. - Fineness by fingering. - It should float on water. - It should not dissolve under water when immersed with perfect shape.	**1M each**
Q.3	**Attempt any FOUR of the following**	**16 M**
a)	**Enlist any four properties of good 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	**1M each**

b)	**State the requirement of good building stone** i. It should have high crushing strength more than 100 N/mm^2 ii. It should have high durability. iii. It should have equi-granular structure. iv. It should have high specific gravity ranges from 2.4 to 2.8 v. It should have low water absorption. vi. It should have better appearance and color. vii. It should be polished properly. viii. It should have high impact value.	**1M each (Any 4)**
c)	**Write any four characteristics of good tile.** **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	**1M each**
d)	**List any four common field test carried out on bricks.** 1. Shape and size 2. Color 3. Structure 4. Soundness 5. Hardness 6. Impact strength	**1M each**
e)	**Write any four properties of Damp-proofing materials**. **Properties of damp proofing materials** 1) It should be impervious in nature 2) It should be strong and durable 3) Material must be able to withstand dead as well as live load without damages 4) It should be dimensionally stable 5) It should be free from deliquescent salts like sulphates, chlorides and nitrates 6) It should be water proof. 7) It should withstand temperature variations and prevent formation of cracks 8) It should get easily mixed with cement, sand and aggregates to form a homogeneous paste.	**1M each**
f)	**Write any four uses of asbestos fibers.** **Uses of Asbestos Fibers** 1. They are used in making bricks. 2. They are used for floor tiles. 3. They are used for manufacturing insulating cement. 4. They are used for manufacturing insulating concrete block. 5. They are used for making textile material. 6. Extensively used in automotive & medical industries. 7. They are commonly used for building wiring.	**1M each**

Q.4	Attempt any FOUR of the following	16 M
a)	**Enlist various test conducted on bitumen and explain anyone** **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/Balance method. **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 100^{o}C below flash point from safety point of view. ***(Students may write any one Test explanation, so give credit accordingly)***	**2M** **2M**
b)	**Define Asphalt. Write any two properties of asphalt.** **Definition-** Asphalt is a natural or artificial mixture in which bitumen is associated with inert mineral matter. In fact, it is the native mixture of hydrocarbons-a product of the decomposition of organic substances. **Properties-** 1. It is black or brownish black in colour. 2. At temperature between 50^{o}-100^{o} C it is in liquid state. 3. Whereas at temp. Less than 50^{o}-100^{o} C it remains in solid state. 4. It is thermoplastic material. 5. It softens as it is heated. 6. It hardens as it is cooled. 7. It is the tough and durable material. 8. It is a waterproof material and can be easily cleaned. 9. It is the good insulator of electricity, heat & sound. 10. It a non inflammable and non absorbent. 11. It is affected by acids and is safe against vermin. 12. It is resilient and reasonably elastic. 13. It is soluble in C_2S, Benzene, Naptha 14. Setting time: Less 15. Uses: As damp proof course, for paints, as roofing felt and for road works.	**2 M** **1/2 M each (any four)= 2M**
c)	**State properties of fine aggregate and course aggregate** **Properties of fine aggregate** 1. Particle size between 75µ to 4.75 mm is Fine aggregate. 2. Particles are mostly rounded shape. 3. Fine aggregate gives bulkiness to concrete. 4. Fine aggregate shows more bulking with increase in moisture upto certain value and again decreases.	**1M each (Any 2)**

	5. These are obtained from sea, river, pit and artificially crushing stones. 6. Less water absorption **Properties of Coarse aggregate** 1 The particle size from 4.75 to 80mm is coarse aggregate 2. The surface texture of aggregate is rough. 3. Water Absorption. 4. Coarse aggregate gives strength to concrete. 5. These are obtained from crushing of natural stones.	**1M each (Any 2)**
d)	**Write any four properties of Geo-synthetic materials.** **Properties-** (1) Light weight. (2) Impervious in nature. (3) Non-degradable. (4) Easy to handle. (5) High transmissibility under strong compression. (6)High tearing strength. (7) High modulus of deformation. (8) Adequate plastic yield properties.	**1 M each**
e)	**Write any four uses 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. **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.** Termotar used in brickwork construction	**1M each**
f)	**Write any four properties of cement mortar.** 1. Mortar must have sufficient strength. 2. It should be capable of developing good adhesion with the building units such as bricks, stones etc. 3. It should be capable of developing the designed stresses. 4. It should be capable of resisting penetration of rain water. 5. It should be cheap. 6. It should be durable 7. It should be easily workable 8. It should not affect the durability of materials with which it comes into contact. 9. It should set quickly so that speed in construction may be achieved. 10. The joints formed by mortar should not develop cracks and they should be able to maintain their appearance for a sufficiently long period.	**1M each**

Q.5	Attempt any FOUR of the following:	16
a)	**State any four properties of hydraulic lime.** 1. It forms hard mass like cement 2. It has slake slowly 3. Lime possesses good plasticity 4. Setting time of hydraulic lime is slow 5. Quality of mortar is strong	**1M each**
b)	**Compare asphalt and tar with respect to:** Setting time Use	**2M** **2M any two pt each**

	Asphalt	Tar
Setting time	More	Less
Use	1.It can be used for preparing paint 2.It can be used as DPC 3.It can be used as water proofing layer. 4.It is used in construction of road	1. It is used for making macadam road. 2. It is used for preserving timber. 3. It is used for water proofing. 4. It is used for painting to metal embedded in ground to avoid corrosion.

c) Explain wet process of manufacturing of cement

Various stages in wet process of manufacturing of cement:

The manufacturing of cement by wet process can be divided into three stages.

Stage-I Mixing of raw materials: **1 ½ M**

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.

Stage-II Burning: **1 ½ M**

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.

	Stage-III Grinding: 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.	**1M**
d)	**State various thermal insulating materials and state any two properties of insulating materials** 1. Rock wool 2. Fibre board 3. Gypsum board 4. flexible blanket 5.cork board 6. Mineral wool board 7.AC board 8. Aluminum foil 9. Gasket cork sheet **Properties :** 1. It should be fire proof and chemical resistance 2. It Should be Bio resistant and dry 3. It should not undergo any deformation 4. It should resist attack of insect 5. It should not absorb moisture 6. It has good strength and stability **7.** It should impermeable to water	**½ X 4= 2M** **ANY TWO 2M**
e)	**Write any two advantage and disadvantage of glass cladding** **Advantages-** 1. Glasswork should add beauty to the building 2. It will save the space inside the building 3. Its use fulfills the architectural view. 4. Glass cladding in building fulfill functional requirement of lighting. 5. Glass is bad conductor of heat; it saves energy in air conditioning of building. **Disadvantages-** 1. It will cause more maintenance cost if it is used in hilly area 2. Unsafe for earthquake proven area. 3. Use of glass also enhances the cost of security 4. As glass is very costly material, it may increase the budgeted cost of construction work	**ANY TWO 2M** **ANY TWO 2M**
f)	**Write any four properties of sound insulating material.** 1. It should be light in weight 2. Easy to handle and fix 3. It should be resistant to attack termite and insect 4. It should have low density and porous texture 5. It should be fire resistance 6. It should be moisture resistance	**1M Each**

Q.6	Attempt any FOUR of the following:	16M
a)	**State importance of special types of bricks and write their applications.** 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	**Any four 1M Each**
b)	**State the importance of flooring tiles and roofing tiles in building and give two names flooring and roofing tiles according to materials.** **Importance of flooring tiles and roofing tiles:** 1. Gives good appearance or attractive look. 2. Easy to clean 3. These are cost effective 4. Longer life span 5. They do not require polishing **Names of Flooring Tiles:** 1.Vitrified Tiles 2. Granomite Tiles 3.Marbonite Tiles 4. Glazed Tiles 5.Spartex Tiles	**Any Two= 2M** **Any Two ½ each= 1M**

	Names of Roofing Tiles: 1. Allahabad Tiles 2. Corrugated Tiles 3. Guna Tiles 4. Manglore Tiles 5. Flemish Tiles 6. Ranigunj Tiles 7. Country Tiles	**Any Two ½ each= 1M**
c)	**What are the ingredients of good mortar and explain how you decide good mortar.** **Ingredients of mortar:** 1) Cement/lime 2) Sand/sinder/surkhi 3) Water **The mortar is said to good if it possess the following properties:** 1) It should be workable 2) It should be tough, hard durable and economical 3) It should be capable of resisting weathering effect 4) It should be easily transported and placed in site 5) It should set quickly	**2M** **2M**
d)	**Write any four applications of construction waste.** 1. Reuse of bricks, stone slab, timber conduct, piping railing, etc to the extent possible and depending upon their condition 2. Plastics, broken glass, scrap metal etc can be used by recycling industries 3. Large unusual pieces can be sent for filling up low lying areas 4. Fine material, such as sand dust etc can be used as cover material over sanitary landfill 5. Rubble, brick bats, broken plaster/concrete piece etc can be used for building activities Such as leveling under coat of lanes where the traffic does not constitute of heavy Moving loads.	**Any Four 1M each**
e)	**Write Two uses of each:** **i) 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. **ii) Construction waste** 1. The pieces of bricks, hardened mortar and concrete can be used in manufacturing of concrete block. 2. Waste from the timber such as saw dust can be used for making light weight concrete. 3.Metal pieces can be recycled and send to metal industries for manufacturing of new product 4. Plastic pieces can be recycled and send to plastic industries for manufacturing of new product.	**½ each =1M** **½ each =1M**

	iii) Rubber Waste 1.Used for erosion control 2. Manufacturing of floor mats 3. By grinding tyres into crumb and using it in asphalt mix 4. Used in core of earthen embankments 5. it is used in manufacturing of foam rubber which is used in furniture **iv) Saw dust** 1.It is used in manufacturing of particle board 2.It is used as alternative to fuel 3.It is also used in artistic display 4.It is used for wood pulp	**½ each =1M** **½ each =1M**
f)	**What is construction waste? How it is applicable in Civil Engineering?** **Construction waste:** It is the unwanted materials produced directly or incidentally by construction activity. These include building materials such as broken concrete, steel, insulation, nails, electrical wiring and waste originating from the site preparation like dredging materials, tree stumps and rubble. **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.	**2M** **Any Two 1M each= 2M**