



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)

(ISO/IEC -270001 – 2005 certified)

SUMMER -2019 EXAMINATION

Subject code: 22204

Model Answer

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

Q. No.	Question and Model Answers	Marks
Q.1.	Attempt any <u>FIVE</u> of the following:	10
a)	State the materials for different civil engineering structures.	
Ans:	1. Natural materials- Stone,Sand,Timber etc.. 2. Artificial materials- Brick, Tile, Cement etc. 3. Special materials- Fibre, Bitumen etc. 4. Finishing materials- POP, Wall Cladding etc. 5. Recycled materials- Fly Ash, Rice Husk etc.	1/2 M each for Any four
b)	State the materials required for irrigation structures in general.	
Ans:	1) Cement 2) Aggregate 3) Sand 4) Soil 5) Brick 6) Fly Ash 7) Tiles 8) Stones 9) Steel 10) Bitumen etc.	1/2 M each for Any four
c)	Define quarrying.	
Ans:	The process of taking out stones from natural rock beds is known as quarrying of Stones.	2M
d)	What is moulding?	
Ans:	Moulding is the process of giving required shape & size to the plastic material (like concrete / clay) till it harden by external surface support.	2M

e)	What are the various operations involved in manufacturing of burnt clay bricks?	
Ans:	Manufacturing of Burnt Clay Brick consists of a) Preparation of clay. b) Moulding c) Drying d) Burning.	1/2M each
f)	What is wall cladding?	
Ans:	Wall Cladding or tiling is a process of finishing the surface with tiles. Due to wall cladding, walls are easy to clean. It protects the exterior surface of building from atmospheric agents.	2M
g)	Enumerate the field tests to which bricks are generally subjected.	
Ans:	Field tests performed on bricks for its suitability: 1) Shape and size 2) Structure 3) Hardness 4) Soundness 5) Color Test	1/2 M each for Any four
Q.2.	Attempt any <u>THREE</u> of the following:	12
a)	Describe the broad classification of materials.	
Ans:	<p>Materials can be classified into following types:</p> <ol style="list-style-type: none"> 1) Natural materials 2) Recycled materials 3) Artificial materials 4) Special materials 5) Finishing materials <p>1) Natural construction materials:- a) Stone- stone is naturally available from rocks by quarrying process. It is dressed to be used for foundation, walls, floorings, kitchen otta etc. It is most strong and durable material. b) Timber- timber is used worldwide as construction material. It is useful for formwork, centering, scaffolding, doors and window frames, shutters, for furniture, as roofing materials, for making railway sleepers, temporary bridges. c) Bituminous materials and mixtures:-asphalt, bitumen and tar are widely used materials. They are obtained from petroleum and used in road construction and for water proofing. They can be used in the form of emulsion, cutback, mastics, sheet rolls etc. d) Lime- lime is obtained from limestone by process of calcination in which carbondioxide and moisture is removed. $\text{CaCO}_3 \text{CaO} + \text{CO}_2$ e) Soil- soil is naturally obtained from disintegration of rocks when they are exposed to atmosphere by weathering agents like sun, wind, rain, frost etc. Soil is used as construction and foundation material. It is used for making earthen dams, canals, embankments. WBM roads. Clay is used in manufacturing of bricks andtiles. Sand is used in filter bed.</p> <p>2) Recycled construction materials:- Rice husk- it is a natural hard coating over rice grain. Rice husk is difficult to burn. The ash has insulating property. It has pozzolonic properties so it is used in manufacturing of bricks and alternative to cement for mortar, foundation and concreting. b) Bagasse-it is fibrous residue left after sugarcane stalks are crushed to extract juice. It is rich in alumina, iron and silica and possesses pozzolonic property. The ash can be mixed in cement or concrete. Bagasse is used in manufacturing of boards, bricks, bio fuels, papers etc. c) Coir Fibers-It is obtained from coconut husk which are present in covering</p>	Any two 2M each

offruit. There may be green, white or brown coir fibers. It is mixed with cementmortar as it increases impact and tensile strength.

d) **Straw**-It is agricultural by product .It is dry stalk of cereal plants like rice, wheat and barley etc. after the grains and chaff is removed. It can be used to bind clay and concrete, for insulation purpose and for roofing.

e) **Fly ash**-Fly ash is produced during combustion of coal generally in power plants. It comprises of very fine particles. It possesses pozzolonic property so it is used in construction as alternative to cement. It is also used in brick manufacturing and soil stabilization.

f) **Construction waste**-It is obtained at construction site after completion of site and after demolition of old structures. It is used in pavement filling, plinth filling and to prepare low grade concrete.

3) Artificial construction material:-

a) **Bricks**- Bricks are made up of clay. They are used in brick masonry construction.

b) **Tiles**- Tile is used for Flooring and roofing. Varies types of tiles are available inmarket like Vitrified, Shahabad, Mosaic etc

c) **Cement**- Cement is a fine grey powder which forms a paste with addition of water.With due time it sets and becomes hard. It is mixture of calcareous, argillaceous orsiliceous material burnt in a furnace which forms stone like mass. It is then grinded to fine powder called cement.

d) **Aggregate**- Aggregates are the materials basically used as filler with binding material in the production of mortar and concrete. They are derived from igneous, sedimentaryand metamorphic rocks

e) **Precast concrete product**- These are the units casted or manufactured in industries or on site. They are ready to use materials thus going speedy Construction

f) **Artificial Sand**- The sand which is obtained from stone crusher after crushing the natural stone.

g) **Particle board** -Particle board is manufactured using chips or particles of low grade wood or sawdust mixed with strong adhesive and then compressed together under high pressure.

h) **Veneers**- Veneers are thin sheets of wood or slices of wood of superior quality obtained by rotating a log a wood against a sharp cutter or saw. The thickness of veneers varies from 0.4mm to 0.6mm or more.

4) Special construction material

a) **Damp-proofing**: Damp proofing is a treatment given to the building components during Construction to prevent entry of moisture.

b) **Water-proofing**- In building construction, mortar brick, stone and concrete are having tendency to get deteriorated due to passage of time. Due to which cracks and pores are formed in this material and water leakage occurs. This leakage of water is stopped by using special materials called as water proofing materials.

c) **Thermal insulating material**- The thermal insulating material is used to conserve a constant heat or temperature inside the building, irrespective of the temperature changes outside.

d) **Artificial Timber** - 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 flyash, silica, bituminous, and other bio-degradable material.

e) **Geo-synthetic materials**- Geo-synthetics are man-made materials used to improve soil conditions. 'Geo' means earth or soil and synthetic means man-made

f) **Fibre**: Fibre is a class of materials that are continuous filaments or are in discrete elongated pieces, similar to length of thread.

5) Finishing construction material:-

	<p>a) Plaster of Paris-A white powder that sets to a hard solid when mixed with water, used for making sculptures and casts, as an additive for lime plasters, and for making casts for setting Broken limbs.</p> <p>b) 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.</p> <p>c) Wall Cladding- Wall cladding is a process of finishing the surface with tiles.</p> <p>d) Paints- paints are applied on the surfaces of timber, metals and plastered surface as a protective layer and at the same times to get pleasant appearance</p> <p>e) Tiles- Tile is used for Flooring and roofing. Varies types of tiles are available in market like Vitrified, Shahabad, Mosaic etc</p> <p>Note:- Student may write any two descriptions. So accordingly credit to be given.</p>	
b)	Describe the field tests for cement.	
Ans:	<ul style="list-style-type: none"> ➤ Open the bag and take a good look at the cement. There should not be any visible lumps. The colour of the cement should normally be greenish grey. ➤ Thrust your hand into the cement bag. It must give you a cool feeling. ➤ Take a pinch of cement and feel between the fingers. It should give a smooth and not a gritty feeling. ➤ Take a hand full of cement and throw it on a bucket full of water, the particles should float for some time before they sink ➤ Take about 100 gms of cement and small quantity of water and make it stiff paste. From the stiff paste, pat a cake with sharp edges. Put it on a glass plate and slowly take it under water in bucket. See that the shape of the cake is not disturbed while taking it down to the bottom of the bucket. After 24 hr the cake should retain its original shape and the same time set to attain some strength. 	Any four 1M each
c)	What are the requirements of good sand?	
Ans:	<p>Requirement of Good Sand :</p> <ol style="list-style-type: none"> 1. Silt Content should be less than 3% by weight (12% by volume in 10 min) 2. Sand should be free from Organic materials, dust, clay etc. 3. Sand shall not contain any harmful impurities such as iron, pyrites, alkalies, salts, coal or other organic impurities. 4. Sand should be well graded. 	1M each
d)	State the applications of soils as a construction material.	
Ans:	<p>Soil is naturally obtained from disintegration of rocks when they are exposed to atmosphere by weathering agents like sun, wind, rain, frost etc.</p> <p>Applications of Soil :</p> <ul style="list-style-type: none"> ➤ Soil is used as construction and foundation material. ➤ It is used for making earthen dams, canals, embankments. ➤ It is used for making WBM roads. ➤ Soil form of clay is used in manufacturing of bricks and tiles. ➤ Sand from soil is used in filter bed. 	Any four 1M each

Q.3	Attempt any <u>THREE</u> of the following	12M
a)	Explain various types of tiles based on their use	
Ans	<p>1. Natural tile: These types of tiles are produced from natural materials that are quarried, finished and cut to size. Common types of stones used as flooring tiles include granite, marble, limestone and slate.</p> <p>2. Artificial tile: These types of tiles are manufactured by the use of natural materials with various process performed on it. Common types are porcelain, mosaics, ceramic tiles used for flooring and decorative purpose.</p> <p>3. Drain tile: These types of tiles are laid in water logged areas and allow the subsoilwater to drain. They may be circular, semi-circular or segmental in shape.</p> <p>4. Floor or paving tiles: These types of tiles are popular in the name of ceramic tiles with various trade names. These tiles have a very attractive look and available in various shades of colour. They have very light weight as compare to mosaic tiles or marble or granite. These tiles are suitable in residential buildings.</p> <p>5. Roof tiles: These tiles are mostly used for covering pitched roof or slope roof. Various types of roof tiles are available in the market in name of Allahabad tiles, corrugated tiles, guna tiles, mangalore tiles, Flemish tiles, flat tiles, pan tiles, pottiles etc.</p> <p>6. Encaustic tiles: Depending upon the addition of coloured pigment in clay, these tiles acquire the desired print or colour after manufacturing. They are famous in the name of galicha tiles.</p>	1 mark each (any four)
b)	Describe the wet process of manufacturing of cement	
Ans	<p>Various stages in wet process of manufacturing of cement: The manufacturing of cement by wet process can be divided into three stages.</p> <p>Stage-I Mixing of raw materials: 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.</p> <p>Stage-II Burning: Burning of the above dried slurry is carried out in a rotary kiln. Kiln rotates at a rate of 1 RPM about its longitudinal axis. The slurry is injected at the upper end whereas the hot gases 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.</p> <p>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.</p>	<p>1 ½ M</p> <p>1 ½ M</p> <p>1M</p>
c)	What are the different types of aggregates ?	
Ans	<p>Aggregate are divided into two categories:</p> <p>1. Coarse Aggregate: The size of aggregate bigger than 4.75mm is considered as Coarse Aggregate. a) Crushed stone particles. b) Brick bats c) Slag</p> <p>2. Fine Aggregate: Aggregate whose size is 4.75mm and less is considered as Fine Aggregate. a) River sand. b) Sea sand. c) Pit sand d) Artificial crushed stone sand.</p>	<p>2M</p> <p>2M</p>

d)	Write short note on solid concrete blocks	
Ans	<p>Solid Concrete Blocks:</p> <ul style="list-style-type: none"> • The specification and the characteristics of a solid concrete blocks depend on the machine used to manufacture concrete blocks. • The most common size of solid concrete block is 300 x 200 x 150 mm. The basic raw material is cement, fine aggregate, coarse aggregate and water taken in appropriate proportion. • Mechanical compaction and vibration gives the block high quality in spite of lean mix, which uses very little cement. • Solid concrete block is more cost effective as compared to other traditional walling system • It has high quality, high strength and uniform size and shape. • It is environmental friendly and hence utilizes wastes and local resources. 	4M
Q.4	Attempt any <u>THREE</u> of the following	12 M
a)	What are the properties of tar?	
Ans	<p>Properties:</p> <ol style="list-style-type: none"> i) It is deep black in colour. ii) It contains more carbon content. iii) It has high viscosity. iv) It becomes more fluid when heated. v) It setting time is less. 	1M each (any four)
b)	What are the properties of precast pavement blocks?	
Ans	<p>Properties of precast pavement blocks:</p> <ol style="list-style-type: none"> i) It should have good dimensional stability. ii) It should have non-skid surface. iii) It should have good compressive strength from 20 N/mm² to 50 N/mm² iv) It should have very low water absorption about 5% v) It should have good transverse strength (3 N/mm² and above) vi) It should have average abrasion about 3mm 	1M each (any four)
c)	What are the properties of sound insulating materials?	
Ans	<p>Properties of sound insulating materials:</p> <ol style="list-style-type: none"> 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 (any four)
d)	Explain the process of distempering	
Ans	<p>Process of Distempering: The application of distemper is carried out in the following way</p> <ol style="list-style-type: none"> 1. Surface Preparation: The surface to receive the distemper is thoroughly rubbed and cleaned. New plastered surfaces should be kept exposed for a period to two months or so to dry out before distemper is applied on them. The presence of dampness on the surface results in failure of distemper <i>coating</i>. Irregularities such as cracks, holes etc. are filled by putty. If distempering is to be carried out on an old distemper surface, old distemper should be removed by proper watering. 	2M

	2. Application of coats of distemper: After preparing the surface a primary coat is applied and it is allowed to dry. Over primary coat, coats of distemper of good quality should be applied uniformly in succession. The second coat should be applied only after the first coat has become hard. Distempers should be applied with broad stiff brushes in dry weather. On new plastered walls, distempers should be applied in two or three coats over coat of primer.	2M
Q. 5	Attempt any THREE of the following	12
a)	Explain various types of clays with their suitability.	
Ans.	<p>Types of clays are:</p> <ol style="list-style-type: none"> 1. Refractory clay (Terra cotta clay): This clay is highly disperse and very plastic. This clay contains high percent of alumina. Uses: Used to manufacturing of refractory bricks, cornices, jambs, sills. 2. High melting clay: High melting point clays have high refractoriness @ 1580°C. It contains less impurities like quartz, feldspar, mica, CaCO₃ and magnesium carbonate. Uses: Manufacturing of facing bricks, floor tile, sewer pipes. 3. Low melting clay: Refractoriness less than 1300°C. The composition is not uniform. Uses: Manufacturing of bricks, blocks, tiles. 4. Stoneware / Earthenware Clay: Selected clay mixed with ground glass, stone dust, potteries, sand, etc. Uses: Manufacturing of Pipes for drains & sewers. 5. Kaolin / China Clay: White color pure clay possessing a high degree of tenacity & plasticity. Uses: Manufacturing of glazed pottery, porcelain. 	½ M for type and ½ M for its use (any four Types)
b)	Explain the manufacturing process of hydraulic lime.	
Ans.	<ol style="list-style-type: none"> 1. Burning of impure limestone / kankar containing clay containing less than 30 %. With coal or charcoal as fuel. 2. If soft limestone is used, it is powdered, mixed with clay in right proportion & burnt in kiln. 3. If hard limestone is used, It is burnt & slaked first, mixed with clay and then reburnt. 4. The product on canclination is slaked with water or ground into powder for use in construction. 5. Hydraulic lime slaked with difficulty, therefor lumps of hydraulic lime should be ground before slaking. (time required @ 12 – 48 hrs.) 6. Hydraulic lime is kept in sacks without injury as long as it is protected from air & moisture. After slaking it should be used within a week. 	1 M each (any four)
c)	Give properties and uses of ceramic materials in construction.	
Ans.	<p>Properties:</p> <ol style="list-style-type: none"> 1. It is hard. 2. It is brittle. 3. It is in the form of amorphous (non-crystalline) 4. The structure is glassy. 5. It is insulator thermally & electrically. 6. It behaves elastically at low temp and under proper conditions of stress and temp. It deforms by viscous flow. 7. Less expansion & contraction. 8. Not affected by chemicals. 	½ M each (any four)

	Uses: <ol style="list-style-type: none"> 1. It is used in refractory product manufacturing for thermal insulations. 2. Manufacturing of bricks, tiles. 3. Manufacturing of glass. 4. For making abrasives. 5. For Manufacturing of porcelain. 6. For making POP. 7. For making electric. 8. For Manufacturing of sanitary wares, pavers. 	½ M each (any four)
d)	Explain why you need agro and industrial waste as a construction materials.	
Ans.	<ol style="list-style-type: none"> 1. To maintain ecosystem. 2. To reduce / control pollution. 3. To reduce the cost of construction material. 4. To improve the required properties in construction materials like light weight product, thermal insulation, shock resistant, sound insulation, etc. 5. To solve the problem of industry waste disposal. 6. To conserve the natural resources. 	1 M each (any four)
e)	State the situations where oil paint and distempers are used.	
Ans.	situations where oil paint are used: <ol style="list-style-type: none"> 1. It can be used on dry surface (damp free), on wood & metal works. For enhancing the appearance. 2. To protect the metals works from corrosion. 3. To protect the wood works from attack of termites. 4. To prevent the wood works from humidity. 5. To increase the life of material. situations where distempers are used: <ol style="list-style-type: none"> 1. Commonly used for interior works of buildings on plastered surfaces. 2. Used on wall boards. 3. To enhance the appearance of plaster. 4. To increase life of plaster. 	1 M each (any two) 1 M each (any two)
Q. 6	Attempt any THREE of the following	12
a)	State the properties of an ideal varnish.	
Ans.	<ol style="list-style-type: none"> 1. It should render the surface glossy. 2. It should dry rapidly / quickly. 3. It should form hard, durable, flexible film on painted surface. 4. It should not be affected by atmospheric action. 5. It should stick easily to surface. 6. It should not shrink / cracks after drying. 	1 M each (any four)
b)	Give properties and uses of POP.	
Ans.	Properties of POP: <ol style="list-style-type: none"> 1. Fire resistant 2. Heat resistant 3. Light in weight 4. Not affected by bacteria. 5. Sets without shrinkage within 5 minutes. 6. Good adhesion to the plaster, wood work. 7. Can be molded to any shape. 8. It is hard after molding. 	1 M each (any two)

	Uses of POP: <ol style="list-style-type: none"> 1. As an insulation material from heat action. 2. Ornamental work on plastered surface. 3. Used in artwork, pottery. 4. Sound insulating boards. 5. For partition wall. 	1 M each (any two)
c)	Write any two uses of rice husk and coir fibre.	
Ans.	Uses of rice husk : <ol style="list-style-type: none"> 1. To make sound insulating material. 2. To make thermal insulation. 3. Used in manufacturing of clay bricks. 4. To make high grade concrete & mortar. 5. Used as fuel in boilers & for power generation. 6. To make boards. Uses of coir fibre : <ol style="list-style-type: none"> 1. To make rope. 2. To make door mats, brushes, mattresses. 3. To make floor tiles. 4. Used for thermal insulation. 5. Used for packing delicate articles. 6. Used for geotextile. 7. Used in plaster work to make crack resistant plaster. 	1 M each (any two) 1 M each (any two)
d)	Give the uses of granite & marble polishing waste.	
Ans.	Uses of granite & marble polishing waste : <ol style="list-style-type: none"> 1. Used as fine aggregate in mortar & concrete. 2. Used in manufacturing of bricks. 3. Used in manufacturing of artificial stone. 4. Used in manufacturing of paving blocks. 	1 M each
e)	State the uses of (i) Glass Fibres (ii) Asbestos Fibres.	
Ans.	Uses of Glass Fibres : <ol style="list-style-type: none"> 1. Used as filter in air conditioners. 2. Used as fine aggregate for finishing plaster to reduce cracking. 3. Used with plastic to produce glass reinforced plastic (GRP), for water proofing of roofs. 4. Used in manufacturing of water tanks. Uses of Asbestos Fibres : <ol style="list-style-type: none"> 1. For manufacturing the roofing sheet used with cement. 2. Used to make pipe (rainwater pipe) 3. Used to make damp proof course material by mixing with bitumen to prepare felts. 4. It is used to form asbestos paint. 5. It is used for thermal insulation work for pipe line. 6. Used in electrical insulation work. 	1 M each (any two) 1 M each (any two)