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(REVISION – 2015)

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# THIRD SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY — APRIL, 2017

## CONSTRUCTION MATERIALS AND ENGINEERING

(Common to CE and AR)

[*Time* : 3 hours

(Maximum marks : 100)

## PART — A

(Maximum marks : 10)

Marks

I Answer the following questions in one or two sentences. Each question carries 2 marks.

1. Identify four clay products.
2. Define bulking of sand.
3. Distinguish between asphalt and bitumen.
4. Differentiate shoring and underpinning.
5. State "lean-to roof". (5×2 = 10)

## PART — B

(Maximum marks : 30)

II Answer *any five* questions from the following. Each question carries 6 marks.

1. Describe quarrying by blasting.
2. State the ISI specifications for bricks.
3. Explain the process of painting on new steel works.
4. Discuss the parts of a building.
5. List the types of partitions.
6. Describe the construction of cement concrete flooring.
7. Sketch and mark the parts of a segmental arch. (5×6 = 30)

Marks

## PART — C

(Maximum marks : 60)

(Answer *one full* question from each unit. Each full question carries 15 marks.)

### UNIT — I

III (a) Describe dry process of manufacturing cement. 8

(b) List the sources of sand and its requirements. 7

OR

IV (a) Define workability. List the factors affecting workability. 8

(b) State the uses of mild steel. 7

### UNIT — II

V (a) Enumerate the characteristics of an ideal paint. 8

(b) Specify the types of wood product and its uses. 7

OR

VI (a) Explain the properties of thermal insulating materials. 8

(b) Discuss the types of plastics. 7

### UNIT — III

VII (a) Illustrate the peculiarities of English bond. 8

(b) Discuss the material used for damp proofing. 7

OR

VIII (a) State the advantages and disadvantages of plant pre fabrication. 8

(b) Identify the types of pointing with sketches. 7

### UNIT — IV

IX (a) Outline the requirement of a good floor. 8

(b) Distinguish the parts of a panelled door. 7

OR

X (a) Differentiate King post truss and Queen post truss. 7

(b) Enumerate the requirements of a good staire. 8

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# Construction Materials & Engineering

April-2017

## Part-A.

1. Indentify four clay products

-> Tiles
-> Terra-Cotta
-> Earthenwares
-> Stoneware
-> porcelain
-> Brick.

2. Define Bulking of Sand

The presence of moisture in Sand increases the volume of Sand. This is due to the moisture causes film of water around Sand particles and it results in the increase of volume of Sand.

3. Distinguish between asphalt and bitumen.

Ans. •Asphalt :- It is a mechanical mixture of inert mineral matter like alumina, lime, silica etc and the asphaltic bitumen.

•Bitumen:- It is a binding material whis is present in asphalt. It is also sometimes called the mineral tar. It is obtained by partial distillation of Crude Petroleum.

4. Differentiate shoring & underpinning

Ans •Shoring:- Sometimes the structure, are to be temporarily supported This is achieved by shoring

•Underpinning :- The placing of new foundation below an existing foundation or the process of strengthening the

5. State lean to roof.

× Simplest form of a pitched roof.
× One wall is carried up sufficiently higher than the other one to give necessary slope to roof.
× Also known as pent roof. or Aisle roof.

Part - B.

1. Describe Quarrying by blasting

Ans. There are three methods of quarrying
→ Quarrying with hand tools
→ " " channelling machine
→ " by blasting

Quarrying By blasting - Explosives are used to convert rocks into small pieces of stones
× The purpose is to loosen large masses of rocks and not to violently blow up the whole mass so as to convert it into very small pieces of partically no use
× Used for Hard stones having no fissures or cracks
× The stone obtained are ~~ash~~ usually of small sized they are used as ballast in railways, aggregate for Concrete, road metal etc
× The tools for blasting are Dipper., Jumper, Priming needle, scraping spoon, Tamping bar.

2. State the ISI Specifications for bricks.

→ moulded or machine moulded

③

→ They shall be Free From Cracks and Flaws and nodules of Free lime.

→ Brick with height of 90mm or 70mm will be moulded with a Frog of 10mm to 20mm deep on one of its Flat Sides.

→ Brick with height 40mm or less and as well those made by extusion process may not be provided with frogs

→ The bricks shall have Smooth rectangular face with sharp Corners and shall be uniform in colour.

3. Explain the process of painting on new steel works

Ans → The Surface of iron or steel should be free from rust, grease etc.

→ The Suitable equipment Such as wire-brushes, Scrapers etc are used to remove all loose Scales, marks etc. From the Surface.

→ Water with Caustic Soda or lime is used to remove grease.

→ The cleaned Surface is provided with a Film of phosphoric acid. this Film protects the Surface from rust and also facilitates the adhesion of paint.

→ The paint Suitable to iron & steel Surface should be Selected For each Coat.

→ The Finishing Coat should present a Smoth Finish and precaution should be taken to avoid the presence of brush marks on Final painted Surface.

4. Discuss the parts of a building

Ans. Building parts are divided in to three

1) Foundation
2) plinth and
3) Superstructure

•Foundation:- It is the part of building Constructed below ground level and which is in direct contact with Sub-Strata and transmits all the loads to the Sub-Soil

•Plinth:- It is the building above the ground level and upto the Floor level immediately above the ground. The built up area measure at the plinth level is known as plinth area.

•Superstructure:- It is the part of the building Constructed above the plinth Following are the Structural Components of a building

i) Foundation
ii) Plinth
iii) Masonry or RCC walls & Column

(4) v) Sills, lintels & weather sheds
vi) Doors, windows & ventilators
vii) Roofs
viii) Stairs, lifts, ramps etc
ix) Building Finishes like plastering, painting, whitewashing, Flooring etc
x) Utility Fixtures.

5. List the types of partitions.

Ans. Types of partitions.

-> Brick partitions -> Metal partitions
-> clay block partitions -> Plaster slab partitions
-> Concrete partitions -> Asbestos cement sheet partitions
-> Glass partitions -> Wood wool slab partitions
-> Timber partitions -> Strawboard partitions.

1) Brick partitions :- The half-brick partitions are very common and they may be plain, reinforced or brickmogged
* Plain brick partitions of half-brick thickness cannot take take heavy load and their height is restricted to about 2m or so.
* The reinfored brick partitions of half-brick thickness are more durable and possess more strength.
* The brickmogged partitions consist of a framework of timber within which half-brick partitions are fitted.

2) clay block partitions :- The blocks are prepared from clay or terra-cotta and they may be either solid or hollow The blocks are usually of section 300mm x 200mm x

3) Concrete Partitions :- It is possible to Construct Partitions of Concrete which may be either pre-cast or Cast-in-Situ. In case of pre-cast Concrete work, the Concrete Slabs of Suitable Size are prepared and they are Secured to the Pre-Cast Posts.

4) Glass Partitions :- The glass is used either in the form of Sheets or hollow blocks. A timber Framework is prepared and then Sheets of glass are inserted in the panels.

5) Timber Partitions :- The wooden Framework is Properly Supported on Floor and Fixed to the side walls.

6. Discribe the Construction of Cement Concrete flooring

Ans. The thickness of Concrete layer is about 40mm and it is Carried out in proportion of 1 part of Cement, 2 parts of Sand and 4 parts of Coarse aggregate by Volume. The Size of Coarse aggregate varies From 20mm to 6mm. The Square or diagonal lines are marked on the Concrete Surface when it is still wet.

→ At places where hard wearing Surface is required the Granolithic Finish is Carried out above the layer of Cement Concrete

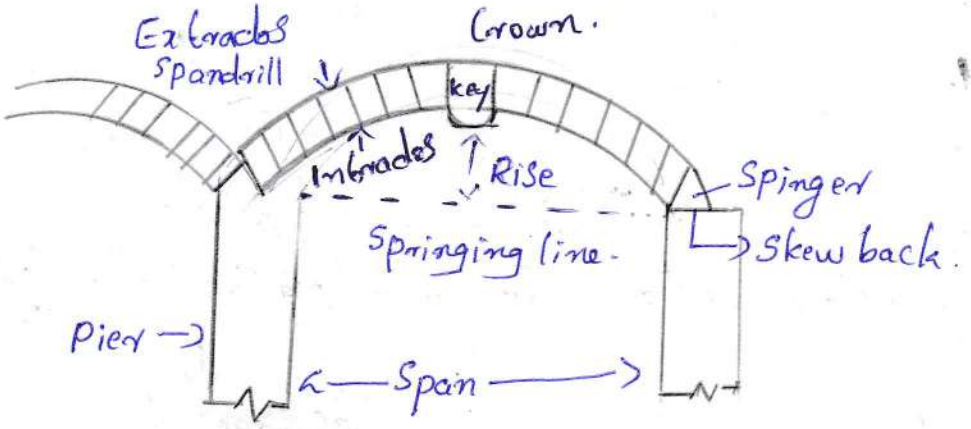
→ Granolithic Concrete - Cement, Sand & aggregates.

→ For hard Surface Sand is replace by Fine aggregates.

→ The Granolithic Concrete should be laid before the base Concrete has Set and its thickness varies From 10 - 20mm.

7. Sketch and mark the parts of a Segmental arch

Ans.




Part-C.

III. a) Describe dry process of manufacturing Cement

The main process of manufacturing of cement consist of

1) Mixing of raw materials
2) Burning
3) Grinding.

The raw materials such as limestone or chalk and shale or clay may be ~~either~~ mixed either in dry condition or in wet condition.

- In Dry process the raw materials are first reduced to in size of about 25mm in crushes. A current of dry air is then passed over these dried materials. These dried materials are then pulverised into fine powder in ball mills and tube mills. All these prosses are done separatetly for each raw material and they are stored in hoppers. They are then mixed in correct proportions and made ready for the feed of rotary kiln.

Calcareous material Limestone

↓

Crushing

↓

Fine Grinding in Ball mills & tube mills

↓

Storage basin

→ channel.

Argillaceous material clay

↓

Crushing

↓

Fine Grinding in Ball mills & tube mills.

↓

Storage basin

← channel

Mixing in correct proportions.

↓

Preheating @ 800°c by exhaust gases

↓

Storage tank for raw mix.

↓

Fuel Fed From lower end → Fed to rotary kiln

↓

Clinkers are Formed

↓

Adding of 2 to 3% gypsum. → Clinkers are ground in Ball mills

↓

Cement silos

↓

Packing plant

b) List the Soures of Sand & its requirements

Ans. According to natural Sources Sand is divided into

i) Pit Sand

ii) River Sand

i) Pit Sand :- This Sand is found as deposits in soil and it is obtained forming pits into soil

* It is excavated from a depth of about 1m to 2m from GL
* The pit Sand consists of sharp angular grains which are free from salts and it proves to be excellent material for Mortar
* Use for making mortar, the clean pit Sand free from organic matter and clay should only be used.

ii) River Sand :- The Sand is obtained from banks or beds or rivers.

* The Sand consists of fine rounded grains probably due to mutual attrition under the action of water current.
* The colur of river Sand is almost white.
* Use for all purposes.

iii) Sea Sand :- It is obtained from Sea shores. The Sea Sand like river Sand, consists of fine rounded grains.

* The Colour of Sea Sand is light brown. It Contains Salts.
* These Salts attract moisture from the atmosphere.
* The Sea Sand also retards the setting action of cement
* It is the general rule to avoid the use of Sea Sand for engineering purpose except for Filling of basements etc.
* It cand however be used as a local material after being thoroughly washed to remove the salt.

IV a) Define Workability. List the factors affecting workability

between the forms with minimum loss of homogeneity

* It is a Physical property of Concrete alone irrespective of a Particular type of Construction can be defined as the amount of useful internal work necessary to produce Full Compaction.

Factors.

-> If more water is added to it results into Concrete of low strength & poor durability.

-> The water cement ratio

-> Aggregate - Cement ratio

-> By Grading, shape, texture and maximum size of the Coarse aggregates to be used in the mixture.

b) State the uses of mild steel.

Ans. i) It can be magnetised permanently

ii) Readily forged and welded.

iii) Used For all types of structural works

iv) It is not easily attacked by salt water

v) Used in motor body, sheet metal, tin plate etc

V
a) Enumerate the characteristics of an ideal paint?

Ans i) It should possess a good Spreading power
ii) The paint should be fairly cheap & economical
iii) The paint should be such that it can be easily and freely applied on the surface
iv) The paint should be such that it dries in reasonable time and not too rapidly
v) The paint should be such that its colour is maintained for a long time
vi) The paint should form a hard and durable surface.
vii) The paint should not affect health of workers during its application.
viii) It should not be affected by weathering actions of the atmosphere.

b) Specify the types of wood product and its uses.

Ans Batten :- This is a timber piece whose breadth and thickness do not exceed 50mm.

Veneers :- There are thin sheets or slices of wood of superior quality. The thickness of veneers varies from 0.40mm to 6mm or more.

Plywood :- The plywood are boards which are prepared from thin layers of wood or veneers. They are light in weight.

Fibre boards :- There are rigid boards and they are

VI a) Explain the properties of thermal insulating materials.

Ans. The temperatures inside and outside a building are different. Some building materials allow heat to pass rapidly while others do not allow. The main aim of thermal insulation is to minimize the transfer of heat between outside and inside of the building

* The choice of an insulating material depends on its cost, Area to be covered, standard of insulation required and the cost of heating or cooling.
* The material should be reasonably fire-proof, non-absorbent of moisture, able to resist attack of small insects and not liable to undergo deformation.
* materials are rock wool, slag wool, Fibreboards, Flexible blankets, Saw dust etc.

b) Discuss the types of plastics

Ans. i) Behaviour with respect to heating

-> Thermo-plastic
-> Thermo-Setting

Thermo plastic :- The thermo-plastic or heat non-Convertible group is the general term applied to the plastic which become soft when heated and hard when cooled. It is thus possible to shape and reshape these plastics

Thermo Setting :- The thermo-Setting or heat Convertible group is the general term applied to plastic which become rigid when moulded at suitable pressure and

ii) Structure.

→ Homogeneous plastic :- This plastics of ~~this~~ group are composed only of carbon atoms & exhibit homogeneous structure

→ Heterogeneous plastic :- This plastic Contains ~~composed~~ ~~chain~~ carbon & oxygen. the nitrogen & other elements

iii) Physical and mechanical properties

→ Rigid plastic → Semi-rigid plastics

→ Soft " → Elastomers.

NII a) Illustrate the peculiarities of English bond

Ans. × The alternate courses of consist of stretchers and headers

× The queen closer is put next to the quoin header to develop the face lap.

× Each alternate header is centrally supported over a stretcher.

× The bricks in the same course do not breake joints with each other. The joints are straight.

× The continuous vertical joints are not formed except at certain stopped ends

× A header course should never start with a queen closer

× The queen closers are not required in the stretcher course.

b) Discuss the materials used for damp proofing

Ans 1) Hot bitumen :- It is a flexible material and is placed on the bedding of concrete or mortar. minimum thickness 3mm

2) Mastic asphalt :- This is a semi-rigid materials and it forms an excellent impervious layer of

damp-proofing. The good asphalt is a very durable and completely impervious material.

3) Bituminous Felts:- It is a Flexible material. It is easy to lay and is available in rolls of normal wall width. It is laid on a layer of cement mortar. An overlap of 100mm is provided at the joints and full overlap is provided at all corners.

4) Metal Sheets:- The sheets of lead, copper and aluminium can be used as the membranes of damp-proofing.

5) Stones:- The two courses of sound and dense stones such as granites slates etc laid in cement mortar with vertical breaking joints can work as an effective damp-proofing course.

VIII a) State the advantages & disadvantages of plant Pre Fabrication.

Ans.

| Advantages | Disadvantages |
|---|---|
| → Construction and Assembly benefits | → Transportation Limitation. |
| → Reduce labour hour | → Shipping Constraints |
| → Reduce material waste. | → Transportation Cost |
| → Manufaturing benifits | → Transportation cost depence on distance, permit allocation etc. |

(9)

b) Identify the types of pointing with sketches.

i) Beaded pointing :- It is formed by a steel or iron rod with a concave edge. It is good in appearance but it is difficult to maintain as it can be easily damaged.

ii) Flush pointing :- It is formed by removing the excess mortar from the joint. The joint is made flush with the face. This does not give good appearance.

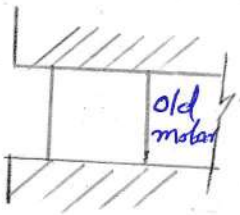

Beaded pointing


Flush pointing

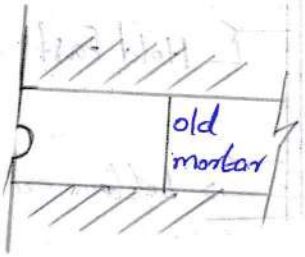
iii) Recessed pointing :- The face of the pointing is kept vertical & it is pressed inside the wall surface by a suitable tool to a depth of about 5mm or more.

iv) Rubbed pointing :- A groove is formed at the centere of height by a pointer. It have better appearance.

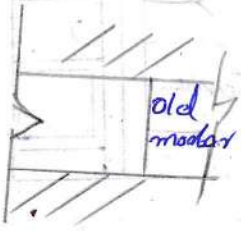
v) Vee-pointing :- Vee-shaped groove is formed in the mortar joint.




Recessed pointing




Rubbed pointing




Vee-pointing

IX a) Outline the requirement of a good Floor

Ans. x The Flooring material should be of desired appearance & it should produce the colour effect in conformity with the use of building

x ~~Flooring~~ The Flooring material should be such that it can be easily and effectively cleaned

x It should be such that it gives comfort when used.

x Cost should be reasonable as compared to the utility of building

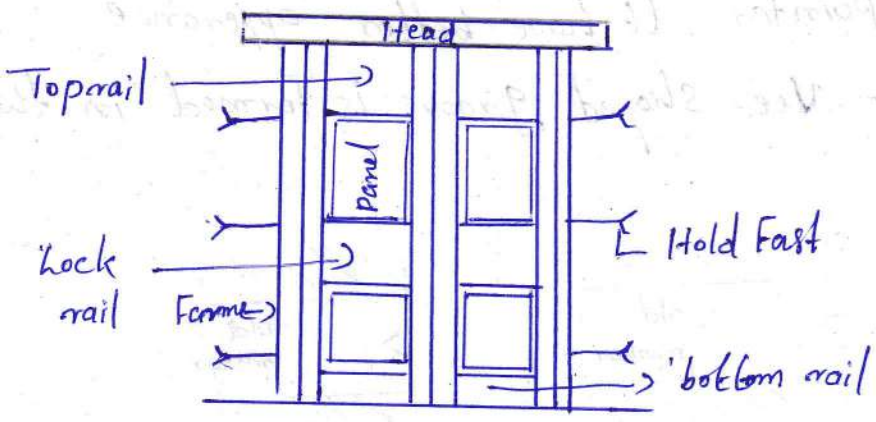
x It should offer sufficient resistance against dampness

x It should be durable & strong

x It should offer sufficient fire resistance.

x It should be sufficiently hard so as to have resistance to marks or signs caused by shifting or rubbing of Furniture, equipment etc.

b) Distinguish the parts of a panelled door.




i) Frame :- This consists of a group of members which form a support for a door

ii) Head :- The top part of a frame

iii) Top rail :- Topmost h/z member of the shutter.

iv) Lock rail :- The middle horizontal member of shutter where the locking arrangment is provided.

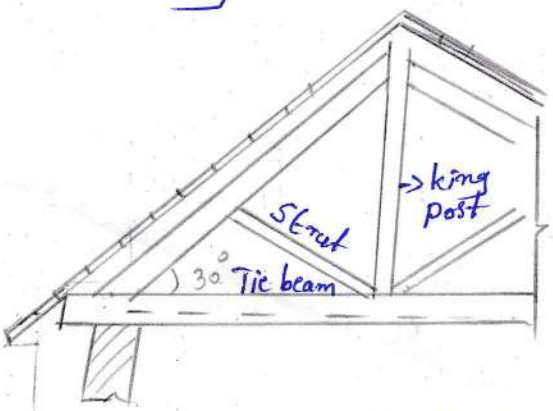
v) Bottom rail :- This is the lowermost horizontal member.

vi) Panel :- This is the area of shutter enclosed between the adjacent rails.

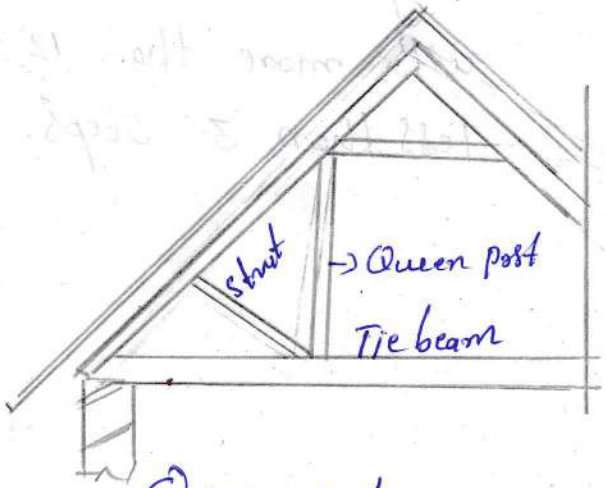
X a) Differentiate king post truss and Queen post truss

Ans. king post truss :- In this type of truss the central post known as a king-post, forms a support for the tie beam. The inclined members known as the struts, prevent the principal rafters from bending in the middle. It is suitable for roofs of span varying from 5m to 8m.

Queen post truss :- This truss differs from king-post truss in having two vertical members known as Queen-posts. The upper ends of the queen-post are kept in position by mens of a horizontal member known as a straining beam.




king post truss.




Queen post.

b) Enumerate the requirements of a good staire

Ans. 1) Design of layout :-

∝ Number of risers = $\frac{\text{Total height of floor}}{\text{height of riser}}$

∝ Number of treads = Number of risers - 1

2) Treads and raisers.

3) Materials and workmanship :- The stair should be Constructed of Sound materials and good workmanship So as to impart durability and strength to the stair.

4) width :- The width of a stair should be sufficient for two persons to pass on it simultaneously and for Furniture etc.

5) pitch :- The Inclination of a stair to the horizontal Should be limited to 30° to 45°.

6) Head room :- The provision of an adequate headroom is necessary.

7) Flight :- It is not ~~possible~~ desirable to provide a flight with more than 12 or at the most 15 steps and not less than 3 steps.