

**THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATION COUNCIL
DIPLOMA IN TECHNICAL EDUCATION EXAMINATION**

784

**BRICKWORK AND MASONRY
(SUPPLEMENTARY)**

Time: 3 Hours.

SOLUTIONS

Year: 2020

Instructions

1. This paper consists of **six (6)** questions.
2. Answer question number **one (1)** and any other **four (4)** questions.
4. Mathematical tables and non-programmable calculators may be used
4. Cellular phones are **not** allowed inside the examination room.
5. Write your **Examination Number** on every page of your answer booklet

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1.(a) Briefly explain the drainage of a residential building.

Drainage of a residential building refers to the system of pipes, fittings, and disposal units designed to safely remove wastewater and surface water from the building to prevent flooding, dampness, and health hazards. It includes soil pipes, waste pipes, inspection chambers, septic tanks, and soak away pits arranged to ensure smooth flow and hygienic disposal of effluents.

(b) Explain eight principles of a good drainage.

A good drainage system should have adequate gradient so that wastewater flows by gravity without stagnation. This prevents blockage and foul smell within the system.

The drainage should be watertight to prevent leakage of sewage into the surrounding soil, which could contaminate groundwater and weaken building foundations.

Proper ventilation must be provided through vent pipes to allow escape of gases and maintain atmospheric pressure in the system, preventing siphoning of traps.

The system should have inspection chambers at suitable intervals to allow easy inspection, cleaning, and maintenance of pipes.

Durable and corrosion resistant materials should be used so that the drainage system can withstand chemical action and long-term use.

The drainage layout should be as simple and straight as possible to reduce sharp bends that may cause blockages.

Adequate trapping should be provided at fixtures to prevent foul gases from entering living spaces.

The drainage system should be designed to separate solid waste from liquid effluent where necessary, improving treatment efficiency.

(c) Figure 1 is a plan of a residential house. Suggest the position of inspection chambers, septic tank, and soak away pit using the method of:

(i) Combined system

In the combined system, wastewater from W/C, shower, kitchen, and surface water are conveyed through a single drainage line. Inspection chambers should be placed at junctions where branch drains meet the main drain and at changes in direction outside the building. The septic tank should be located at a safe distance behind the house, preferably downhill, receiving all combined effluent. The soak away pit should be positioned further away from the septic tank to allow treated effluent to percolate safely into the ground.

(ii) Separate system

In the separate system, foul water from W/C and bathrooms is separated from surface and kitchen wastewater. Inspection chambers should be placed along both systems at junctions and bends. The septic tank should receive only foul sewage from the W/Cs and bathroom areas and be located behind the building. The soak away pit should be connected to the septic tank outlet, while surface and kitchen wastewater is directed to a separate soak pit or drain away from the building.

2.(a) How can you help your workers to understand the meaning of the following terms as used in building construction before commencement of work?

(i) Mortars

Mortar can be explained as a workable paste made by mixing cement or lime with sand and water, used to bind bricks or blocks together. Demonstrating its mixing process and application on site helps workers understand its purpose and correct usage.

(ii) Aggregates

Aggregates are granular materials such as sand, gravel, or crushed stone used in concrete and mortar. Showing samples of fine and coarse aggregates and explaining their role in strength and volume improves workers' understanding.

(iii) Concrete

Concrete is a composite material made from cement, aggregates, and water that hardens into a strong mass. Practical demonstrations of mixing, placing, and curing concrete help workers understand its importance in structural works.

(b) Suggest the five functional requirements of a good mortar to behave.

A good mortar should have adequate strength to bond masonry units firmly and support structural loads.

It should be workable enough to spread easily and fill joints completely without excessive effort.

The mortar should have good adhesion to bricks or blocks to ensure proper bonding.

It should be durable and resistant to weathering and moisture penetration.

The mortar should be compatible with the masonry units so that it does not cause cracking or damage.

(c) Describe the three common types of mortar with their proper reasonable ratio.

Cement mortar is made from cement and sand, commonly in the ratio of 1:3 to 1:6, and is used where high strength and durability are required.

Lime mortar consists of lime and sand, usually in the ratio of 1:2 or 1:3, and is used for plastering and restoration works due to its flexibility.

Gauged mortar is a mixture of cement, lime, and sand, commonly in the ratio of 1:1:6, combining strength and workability for brickwork.

3.(a) Explain the following terms as used in brickwork and masonry.

(i) Pointing

Pointing is the finishing of mortar joints on masonry surfaces to improve appearance and protect joints from weather effects.

(ii) Jointing

Jointing refers to the process of shaping and finishing mortar joints during brick laying to ensure uniformity, strength, and neat appearance.

(b) With the aid of sketches, briefly explain the following points as used in mortar joint.

(i) Recessed pointing

Recessed pointing is a type of pointing where the mortar is pressed back slightly from the face of the brick, creating a shadow line that enhances appearance but requires good weather resistance.

(ii) Keyed pointing

Keyed pointing involves pressing the mortar and then forming a groove along the center of the joint, improving water shedding and decorative appearance.

(c) Illustrate the five important procedures to be followed during preparation of clay bricks.

The clay should first be excavated and cleaned to remove impurities such as stones and roots.

The clay is then prepared by weathering and mixing with water to achieve uniform plasticity.

Moulding is carried out by shaping the clay into bricks using hand moulds or machines.

Drying follows, where moulded bricks are air dried to remove moisture gradually.

Finally, firing is done in a kiln to harden the bricks and develop strength.

4.(a) Briefly explain the importance of providing openings in walls.

Openings in walls are important for allowing natural light and ventilation into buildings, improving comfort and reducing reliance on artificial lighting. They also provide access and movement through doors and windows and enhance the aesthetic appearance of structures.

(b) With the aid of a well labeled sketch, describe the following items as used in the construction of openings in the wall.

(i) Head

The head is the top horizontal part of an opening that supports the load above, often reinforced with lintels or arches.

(ii) Jambs

Jambs are the vertical sides of an opening that support the head and provide fixing surfaces for doors and windows.

(iii) Reveals

Reveals are the exposed vertical surfaces formed by the thickness of the wall at openings, improving finish and weather protection.

(iv) Threshold

The threshold is the bottom horizontal member of a doorway that provides a transition between spaces and protects against moisture ingress.

(v) Span

Span is the horizontal distance between the two jambs of an opening and determines the size of the lintel or arch required.

(c)(i) What do you understand by the term bridging an opening?

Bridging an opening refers to providing a structural member such as a lintel or arch above an opening to support the load of the wall or structure above it.

(ii) With the aid of sketches, describe a brick lintel, reinforced concrete lintel, and a segmental arch structures used for bridging an opening.

A brick lintel consists of bricks laid horizontally with reinforcement or special arrangement to span an opening.

A reinforced concrete lintel is a precast or cast in situ concrete beam reinforced with steel bars to carry loads efficiently.

A segmental arch is a curved structure made of bricks or stones that transfers loads sideways to the supports.

5.(a) What is the purpose of floor as used in ground level of a building?

The floor at ground level provides a firm, level surface for occupants and furniture while protecting the building from ground moisture and dampness.

(b) Propose the kind of floor finish which can be applied in the following structures.

(i) Warehouse

A concrete or epoxy floor finish is suitable for warehouses due to its high strength and resistance to heavy loads.

(ii) Hospital

A smooth, non-slip vinyl or terrazzo floor finish is suitable for hospitals due to hygiene, ease of cleaning, and durability.

(c) With the aid of a labeled sketch, explain timber raised floor.

A timber raised floor consists of timber joists supported above ground level, with floorboards fixed on top. It allows ventilation beneath the floor and prevents dampness.

(d) Describe the following materials used for construction of solid ground floor.

(i) Blinding

Blinding is a thin layer of sand or lean concrete laid over hardcore to provide a smooth surface for further construction.

(ii) DPM

Damp proof membrane is a plastic sheet laid to prevent moisture from rising into the floor structure.

(iii) Cement screed

Cement screed is a thin finishing layer of cement and sand laid over concrete to provide a smooth and level surface.

6.(a)(i) Explain the term stone work.

Stone work refers to construction using natural stones bonded together with mortar to form walls, foundations, or decorative features.

(ii) Describe eight tools which are used for stone work.

A mason's hammer is used for breaking and shaping stones. A chisel is used for dressing stone surfaces. A mallet helps strike chisels safely. A trowel is used to apply mortar. A spirit level checks horizontality. A plumb bob ensures vertical alignment. A tape measure is used for accurate measurements. A square checks right angles.

(b) Distinguish the following stone work.

(i) Uncoursed random rubble and coursed random rubble walls.

Uncoursed random rubble walls use stones of irregular size without uniform layers, while coursed random rubble walls arrange stones in approximate horizontal layers.

(ii) Square rubble and regular coursed rubble walls.

Square rubble walls use roughly squared stones with irregular courses, while regular coursed rubble walls use stones of uniform height laid in regular courses.

(c)(i) What is dressing?

Dressing is the process of shaping and finishing stones to required size and surface texture before use in construction.

(ii) State three types of rocks applied for stone work.

Igneous rocks such as granite are used for strength, sedimentary rocks such as sandstone are used for ease of dressing, and metamorphic rocks such as marble are used for decorative purposes.