THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

784 **BRICKWORK AND MASONRY**

Time: 3 Hour. **ANSWERS** **Year: 2000**

Instructions

1. This paper consists of sections **six (6)** questions.
2. Answer question number **one (1)** and any other **four (4)** questions.
3. Question 1 carries **thirty-two (32)** marks and the rest carries **seventeen (17)** marks each.
4. Non-programmable calculators may be used.
5. Communication devices and any unauthorized materials are **not** allowed in the examination room
6. Write your **Examination Number** on every page of your answer booklet.

1. (a) (i) Define the term "structural integrity" as applied in masonry construction.

Structural integrity in masonry refers to the ability of a structure or wall to withstand the loads and forces acting upon it without collapsing or suffering major deformation. It implies that the masonry elements are stable, durable, and well bonded, maintaining their form and function over time.

(ii) Discuss four factors that determine the structural integrity of a masonry wall.

The quality of materials used—bricks, blocks, mortar, and reinforcement—greatly affects integrity. Poor materials lead to weak bonding and reduce the wall's strength.

Proper wall bonding patterns ensure even distribution of loads and prevent vertical joints from aligning, which can cause cracking.

Foundational stability is critical, as any weakness or settlement at the base compromises the entire wall above.

Environmental exposure, such as moisture, temperature changes, and wind loads, affects wall durability. Protective measures like damp-proofing and finishes help maintain integrity.

(iii) Explain the role of site supervision in maintaining masonry quality.

Site supervision ensures that construction follows the specified standards and drawings. It involves checking the alignment, level, materials, bonding, mortar mixing, curing, and overall workmanship. Prompt corrections during work prevent structural defects and wastage.

2. (a) (i) Identify five challenges commonly encountered when working with natural stones in masonry.

Natural stones vary in size and shape, making it difficult to achieve uniform joints and alignments.

Stones are often heavy and require mechanical lifting, which increases labor and equipment costs.

Cutting and dressing stones demand skilled labor and special tools, which are not always available.

Some stones absorb water, leading to dampness and poor adhesion with mortar.

Transporting stones from quarry to site is expensive and can damage fragile pieces.

(ii) Explain how each challenge can be addressed to ensure acceptable construction standards.

Size irregularities can be minimized by pre-selecting and grouping stones with similar dimensions.

Mechanical handling equipment should be used to lift and position heavy stones safely and efficiently.

Proper training and provision of appropriate tools ensure effective dressing and fitting on site.

Water-absorbent stones should be sealed or treated before use, and suitable waterproofing mortar applied.

Transport damage can be avoided by careful packaging, stacking, and using protective padding during transit.

(iii) Justify the continued use of stone despite these challenges.

Stones are extremely durable, resistant to weather and fire, and require minimal maintenance over time. Their natural appearance provides aesthetic value, and in certain regions, they are locally available and cost-effective in the long run.

3. (a) (i) What are construction joints in masonry walls?

Construction joints are intentional interruptions in masonry work, formed when building is paused and resumed later. They allow separate work periods without compromising the structural and visual continuity of the wall.

(ii) Distinguish between cold joints and day work joints.

Cold joints occur when fresh mortar is laid against hardened mortar from previous work, often without proper bonding preparation.

Day work joints are deliberate pauses in construction at logical stopping points within a day's work, usually formed cleanly and planned.

(iii) Analyze the impact of poorly treated joints on wall stability.

Improper joints form weak planes in the wall, making it susceptible to cracks, water ingress, and reduced load capacity. They can also create visual defects and reduce the overall cohesion of the structure.

(iv) Propose a step-by-step procedure for ensuring proper joint formation during multi-day construction.

At the end of a workday, clean the last course and leave the surface rough or stepped to allow keying.

Before resuming, wet the joint to avoid rapid moisture absorption from new mortar.

Apply a bonding agent or fresh mortar slurry before laying the new course.

Ensure alignment and bonding match the original wall pattern to maintain continuity.

4. (a) (i) Define the term "masonry arch."

A masonry arch is a curved structure made of wedge-shaped masonry units (voussoirs) arranged around a central stone (keystone). It spans an opening and transfers loads to the sides via compression through the curved profile.

(ii) Explain five reasons for the historical use of arches in both structural and decorative masonry.

Arches efficiently transfer loads to supports, allowing wide openings without beams.

Their curved shape offers visual elegance and was used symbolically in religious and royal buildings.

Arches can be constructed from small units (bricks/stones), making them material-efficient.

They are highly durable due to compression strength and resistance to bending.

In heritage and traditional architecture, arches mark entrances, windows, and public spaces with grandeur.

(iii) Discuss three construction techniques that ensure a well-formed arch.

Accurate centering must be built to hold the arch shape during construction.

Each voussoir should be cut and positioned carefully with consistent joints and mortar bedding.

The keystone should be placed last, locking all units into position before curing.

(iv) Describe the importance of the centering system and how it is removed safely after arch completion.

The centering supports the arch until the mortar has cured and the structure is self-supporting. It must remain undisturbed during this period. Removal is done slowly from the center outwards to avoid sudden load shifts and ensure stability.

5. (a) (i) Explain the concept of wall bonding and its relationship to crack prevention.

Wall bonding refers to the arrangement of bricks or blocks to ensure strength and cohesion. Proper bonding avoids the alignment of vertical joints across courses, which helps distribute loads uniformly and reduces the risk of cracks forming along weak lines.

(ii) Compare and contrast English bond and Flemish bond in terms of appearance, strength, and application.

English bond alternates courses of headers and stretchers. It is stronger structurally and preferred in load-bearing walls.

Flemish bond alternates headers and stretchers within each course. It is visually attractive but slightly weaker and better for aesthetic walls.

While English bond is faster to lay, Flemish bond requires more cutting and precision.

(iii) Examine three possible causes of failure in bonded walls and suggest preventive measures for each.

Using improper mortar mix can cause joint failure. To prevent this, use the specified mortar ratios and mix on clean platforms.

Poorly aligned courses can weaken bonds. Always use levels, lines, and plumb rules to maintain accuracy.

Lack of curing dries out mortar too quickly. Cure walls for at least 7 days using water spraying or wet hessian coverings.

6. (a) (i) Outline the standard procedures for preparing mortar before blocklaying begins.

First, the materials (cement, sand, water) must be proportioned accurately by volume or weight.

Sand is placed on a clean mixing surface, and cement is spread evenly over it.

Dry mixing is done until a uniform color is achieved.

Water is gradually added while mixing continues to reach the required workability.

The mortar is then used within 90 minutes to ensure strength.

(ii) Describe how poor mortar preparation can affect the final wall performance.

Poorly mixed mortar can result in weak joints, leading to cracking or separation of blocks. Inconsistent water content may cause shrinkage or loss of bonding strength. These defects reduce the wall's durability and stability.

(iii) Discuss the implications of using expired or contaminated cement in blockwork.

Expired cement may have lost its binding properties due to moisture absorption, leading to low compressive strength. Contaminated cement with lumps or impurities causes inconsistent setting and bonding failure, compromising the entire structure.

(iv) Identify three best practices for mortar storage and handling on a construction site.

Cement bags should be stored on wooden pallets in a dry, ventilated room to avoid moisture absorption.

Sand must be kept clean and free from organic matter or mud to maintain mortar quality.

Only enough mortar should be mixed for immediate use, and leftovers should be discarded to avoid reusing hardened or set materials.