THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

783 **BUILDING CONSTRUCTION**

Time: 3 Hour. **ANSWERS** **Year: 2020**

Instructions

1. This paper consists of sections **five (5)** questions.
2. Answer all questions.
3. Each question carries **twenty (20)** marks.
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) A residential building is planned in a coastal region. Suggest with two reasons the most suitable type of roof that should be used.

The most suitable roof for a coastal region is a **hipped roof**. This is because all its sides slope downwards, which makes it more stable against strong coastal winds. Wind pressure is evenly distributed across all four sloping sides, reducing the chance of roof uplift or collapse compared to gable or flat roofs.

Another reason is its superior **drainage performance**. In coastal areas where heavy rainfall is common, hipped roofs help rainwater quickly flow off all sides, minimizing chances of water leakage or damage to roofing materials and supporting structures.

(b) One effective method to prevent corrosion in metal roofing is **galvanization**, which involves coating the metal with a layer of zinc. This layer acts as a barrier and also sacrifices itself over time, offering corrosion resistance to the base steel or iron material underneath.

Another method is using **protective coatings or anti-rust paints**. Special paints form a shield over the metal, isolating it from moisture, salt, and oxygen that are abundant in coastal environments. Regular maintenance with these coatings can significantly extend the lifespan of metal roofs.

(c) Sketch a **hipped roof** with the following labeled:

- Ridge
- Hip rafters
- Common rafters
- Eaves
- Fascia board
- Gutter

2. (a) Explain the steps followed when setting out the corners of a rectangular building on site before excavation.

The process begins with **clearing and leveling the site** to remove vegetation, stones, or debris, creating a suitable base for accurate measurements.

A **baseline is then established** using a builder's line or theodolite. This baseline acts as the reference for all other measurements on site.

Using the 3:4:5 triangle rule or the diagonal method, **right angles are constructed** from the baseline to form the other corners of the rectangle, ensuring squareness of the layout.

Batter boards and strings are set up beyond the excavation lines. These help retain layout reference points even after digging starts.

Finally, **diagonal checks are performed** to verify that opposite corners are equidistant, confirming the accuracy of the rectangular layout.

(b) Three problems caused by poor drainage on construction sites include **water pooling**, which weakens soil and undermines foundation stability, leading to uneven settlement.

Secondly, **construction delays** may result from waterlogged ground making it unsafe or difficult for equipment and workers to operate effectively.

Lastly, poor drainage increases the risk of **foundation cracks or structural instability**, especially if water seeps into uncured concrete or under-supports.

(c) Draw and label four courses of a **Stretcher Bond** showing bricks laid lengthwise in each course with joints staggered for strength.

3. (a) Describe the process of casting a reinforced concrete column using formwork and vibrator.

First, the **reinforcement cage** is fabricated and tied together as per design. It is then properly positioned using cover blocks to ensure correct concrete cover.

Next, **formwork is set up** around the reinforcement cage. It must be tight, vertical, and strong enough to resist the pressure of the concrete.

Concrete is then **poured into the formwork** in layers. After each layer, a **vibrator is inserted** to remove trapped air, ensuring dense and strong concrete.

Once full, the top is leveled and the column is left to cure for the specified period. Formwork is **removed only after curing** to allow the column to gain sufficient strength.

(b) Plasticizers are added to reduce the **water-cement ratio** while maintaining workability. Lower water means stronger, more durable concrete.

Superplasticizers improve **workability in congested reinforcement** areas where placing and compaction would be difficult without increasing water content.

(c) In the dry process of cement manufacturing, **raw materials like limestone and clay** are crushed, dried, and ground into fine powder.

This powder is blended and fed into a **rotary kiln**, where it is heated to form clinker. The kiln operates at around 1450°C, enabling chemical reactions.

The resulting **clinker is cooled**, mixed with gypsum to control setting time, and ground into a fine powder to produce Ordinary Portland Cement.

4. (a) A team of engineers was sent to inspect a proposed construction site in Morogoro. Suggest six key observations they should include in their report.

They should observe the **topography** to determine whether the site requires leveling or slope adjustments.

The **type and stability of soil** must be assessed through test pits or boreholes to ensure foundation suitability.

They should assess the **site's accessibility** for equipment, workers, and delivery of materials.

They need to check the **availability of utilities**, including water, power, and drainage.

Environmental factors such as **flood risk, wind exposure**, and surrounding vegetation should be recorded.

Legal and **land ownership documentation** should be verified to avoid boundary or permit disputes.

(b) To install a DPC, a **horizontal layer of waterproof material** such as bitumen felt is placed in the wall just above the ground level.

The DPC must extend fully across the wall and be embedded in **even mortar bedding** to avoid gaps where moisture could seep through.

Above the DPC, brickwork continues with proper alignment, ensuring the waterproof layer stays intact and effective.

(c) Wear **protective gear** such as gloves, boots, and goggles when handling fresh concrete to prevent skin burns from its alkalinity.

Ensure **formwork is firmly braced** and leak-proof before pouring to prevent collapse or blowouts.

Use **mechanical mixers and vibrators carefully**, following safety instructions to avoid electric shocks or mechanical injuries.

Clean spills immediately and avoid **clutter around working areas** to prevent slips, trips, or falls during concrete placement.

5. (a) Briefly explain the function and importance of expansion joints in modern concrete buildings.

Expansion joints allow **controlled movement** in a building due to thermal expansion and contraction, which is common in large concrete structures.

They prevent the development of **cracks and structural failures** by absorbing the stresses caused by temperature changes, settlement, or seismic activity.

(b) Provide **wide roof overhangs** or verandahs to reduce heat gain through walls and windows.

Use **light-colored surfaces** for roofs and external walls to reflect rather than absorb heat.

Orient windows to reduce **direct sun exposure**, especially on the east and west facades.

Encourage **natural ventilation** through louvered openings and well-placed vents to keep interiors cool.

(c) A **ground beam** is a reinforced concrete member laid at ground level, mostly used to distribute load from superstructure to shallow or poor soil conditions.

A **ring beam** is cast at wall-top level and ties the entire building together horizontally, helping resist lateral loads and prevent wall separation.

(d) Sketch a cross-section of a **ring beam** showing:

- Bottom and top reinforcement bars
- Stirrup ties (links)
- Concrete cover
- Formwork enclosure