THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

783 **BUILDING CONSTRUCTION**

Time: 3 Hour. **ANSWERS** **Year: 2018**

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 five-storey office building is to be constructed in an urban area. Suggest a suitable type of foundation and give two reasons for your choice.

The most suitable type of foundation for a five-storey office building in an urban area is a **pile foundation**. This is because urban areas often have deep layers of weak soil, which cannot support heavy loads from multi-storey buildings using shallow foundations.

Another reason is that pile foundations are ideal for minimizing **ground vibration and settlement**, especially when construction is carried out near other existing structures. Piles transfer the load to deeper, more stable soil or rock layers, ensuring safety and durability.

(b) One major problem that may occur when using an unsuitable foundation is **differential settlement**. This happens when some parts of the building sink more than others, leading to cracks in walls, misalignment of doors and windows, and potential structural instability.

Another problem is **foundation failure**, especially when shallow foundations are used on water-logged or compressible soils. The result could be tilting, collapse, or the need for expensive structural repairs after construction.

(c) Sketch a simple cross-section of a pile foundation. Label the following:

- Pile cap
- Reinforced concrete pile
- Ground level
- Base of pile
- Load transfer path

2. (a) Explain the procedure for constructing a concrete staircase on site.

Construction begins with **measuring and marking the stair dimensions** on the formwork, including tread, riser, landing, and flight height, following the design drawing.

Next, **formwork is erected** to hold the shape of the staircase. This includes vertical supports, stringers, and riser forms. It must be strong enough to resist the weight of concrete without deforming.

Reinforcement bars are then placed within the formwork, tied according to the structural design. They must have adequate concrete cover to prevent corrosion.

Concrete is **poured carefully in layers**, starting from the bottom step upward. A vibrator is used to compact the concrete and remove air pockets. After pouring, the concrete is **cured properly**, and formwork is removed only after the concrete has gained adequate strength.

(b) The first requirement of a good stair is **comfort in stepping**, meaning the rise and tread must follow the recommended ratio to ensure users don't trip or get tired quickly.

Secondly, stairs must have **adequate headroom**, allowing users to ascend or descend without bending or hitting overhead obstructions.

Thirdly, the stair must include **handrails and non-slip surfaces** to ensure user safety, especially in public or commercial buildings.

(c) Sketch two staircase types:

- Dog-legged staircase: Two flights run in opposite directions with no open space between them.

- Open-well staircase: Two flights run parallel with a rectangular or square well in between. Label: flight, landing, newel post, and balustrade.

3. (a) State four factors to consider when selecting materials for external wall construction in a residential building.

One factor is **climate**. In hot areas, materials with high thermal mass such as concrete blocks help regulate indoor temperatures.

Another factor is **cost and availability**. Locally sourced materials reduce construction expenses and support maintenance needs.

Durability is crucial. Materials should be able to **withstand weather conditions** such as rain, sunlight, and wind without deteriorating quickly.

Lastly, **aesthetic value** must be considered. Wall materials should match the desired appearance and blend with the surrounding environment.

(b) Curing is important because it ensures the **continuous hydration of cement**, which leads to strength gain. If concrete is not cured, it dries out quickly and becomes weak, porous, and more prone to cracking.

Curing also helps in controlling the **temperature of the concrete**, especially in hot weather. This prevents shrinkage and surface cracking, improving both strength and durability.

(c) Poor construction can cause **cracks** in walls due to weak mortar, insufficient curing, or uneven foundation settlement.

Dampness may occur if walls are not protected against moisture ingress from ground water or rainfall.

Another defect is **bulging or leaning**, caused by poor bonding or lack of wall ties.

Finally, **hollow or weak joints** may result from improper compaction or use of substandard materials.

4. (a) A new housing project is being planned near a river. Suggest six measures that must be taken to ensure proper site drainage and moisture protection.

A proper **drainage plan** must be established with slope grading to divert water away from the building.

Use of **perimeter drains** or French drains is essential to collect and channel water away from foundations.

The site should be **filled and compacted** with suitable materials to raise the ground level above the expected waterline.

Construction of **retaining walls** may be required to prevent erosion and soil movement from riverbanks.

Installation of **DPC and DPM layers** must be ensured in foundations and floors to prevent moisture from rising.

Finally, **gutters and stormwater drainage pipes** must be installed to control rainwater runoff from roofs.

(b) A damp-proof membrane (DPM) is a **plastic or bituminous sheet** laid below the ground floor slab. It blocks moisture from the ground, preventing it from rising into the slab and damaging the flooring materials.

DPM also protects against **mould, mildew, and decay**, especially in areas with high ground moisture or poor natural drainage.

(c) Gutters should be installed with a **slight slope** towards the downpipes to allow smooth flow of water.

Downpipes must be securely fixed to walls using proper brackets and connected to **storm drains or soakaways**.

All joints must be **sealed properly** with waterproof adhesive or connectors to avoid leakage or overflow during heavy rain.

5. (a) Explain the term “precast concrete” and mention three advantages of using precast elements in building construction.

Precast concrete refers to **concrete elements that are cast and cured in a factory** or controlled environment before being transported and assembled on site.

One advantage is **speed of construction**. Precast elements reduce on-site labor and time since components arrive ready for installation.

Another is **better quality control**, as production in factories ensures consistent curing, mixing, and finishing.

Lastly, precast components reduce **site congestion and waste**, making the construction process cleaner and more efficient.

(b) An **expansion joint** is a gap provided between two concrete elements to accommodate movement due to thermal expansion or contraction.

A **construction joint** is a planned discontinuity between two pours of concrete, usually where one day's work ends, and the next begins. Unlike expansion joints, it doesn't allow movement but must be properly bonded and sealed.

(c) Sketch a section of an expansion joint in a slab. Label:

- Slab 1 and slab 2
- Joint filler (foam or cork)
- Sealant
- Waterproofing tape
- Reinforcement stops

(d) Steel reinforcement must be properly covered to protect it from **corrosion due to moisture or chemicals**. If steel is too close to the surface, it may rust and expand, causing cracks or failure.

The cover also provides **fire resistance**, as concrete insulates the steel against high temperatures, maintaining structural strength during fire exposure.