THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

071 BUILDING CONSTRUCTION

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2016**

Instructions

1. This paper consists of sections A, B and C with total of fifteen questions

2. Answer all questions in section A and B, and two questions in section C.

i. Timber seasoning is the process of
A timbering to trench
B timber conversion
C timber drying
D timber treatment
E timber hardening

Timber seasoning is the process of reducing the moisture content in freshly cut timber to improve its strength, durability, and resistance to decay. The correct answer is C timber drying because the process involves controlled drying of wood to minimize shrinkage and warping.

ii. The foundation wall between base concrete and floor level is known as
A parapet
B skirting
C dado
D plinth
E footing

The foundation wall between the base concrete and the finished floor level is called a plinth. The correct answer is D plinth because it raises the structure above ground level, protecting it from moisture and providing a stable transition between the foundation and walls.

iii. The function of wall ties in the cavity wall is
A to increase the width of the whole wall
B to increase the width of the wall above cave level
C to strengthen the foundation wall and concrete base
D to strengthen the wall by tying outer and inner leaves
E to allow equal settlements of both leaves of the wall

The function of wall ties in cavity walls is to connect the inner and outer layers, providing structural integrity and preventing separation. The correct answer is D to strengthen the wall by tying outer and inner leaves.

iv. A solid floor is composed of two essential components which are
A floor base and flooring
B base concrete and flooring
C timbering and battering
D stones, lime, and cement
E suspended floor and floor finish

A solid floor consists of a concrete base and a flooring layer, ensuring durability and strength. The correct answer is B base concrete and flooring.

v. What is a "verge" in roof construction?
A the projected part of the roof on the gable side
B the projected part of the roof on the sides of the hipped roof
C the timber member forming a valley in a hipped roof
D the timber member giving shape of mansard roof
E the timber member supporting the gutter in the roof

A verge in roof construction refers to the outermost edge of a roof overhanging the gable end of a building. The correct answer is A the projected part of the roof on the gable side.

vi. The suitable door for internal rooms is
A panel doors and match boarded doors
B match boarded doors and flush doors
C match boarded doors
D hollow core flush doors
E ledged battened and braced doors

The most suitable door for internal rooms is one that provides privacy, aesthetics, and functionality. The correct answer is B match boarded doors and flush doors, as these doors are commonly used for internal spaces due to their smooth finish and ability to save space.

vii. In public buildings, the window area required compared to the room floor area is
A 70%
B 40%
C 10%
D 5%
E 20%

The window area in public buildings must be sufficient to allow adequate natural light and ventilation. The correct answer is C 10%, as building regulations typically recommend that windows cover at least 10% of the floor area.

viii. Which one of the following members can be used as an alternative to landing?
A balustrade
B hand rail
C winder
D banister
E balcony

A winder is a staircase component that replaces a landing by using triangular steps to change direction. The correct answer is C winder.

ix. The recommended minimum height for the chimney stack passing through the ridge is
A 750mm
B 915mm
C 815mm
D 1000mm
E 600mm

The height of a chimney stack is essential for effective smoke dispersion. The correct answer is B 915mm, as it allows for proper draft and prevents smoke from re-entering the building.

x. Which type of pipes are not recommended in soft water supply schemes?
A galvanized steel pipes
B steel pipes
C PVC pipes
D cast iron pipes
E lead pipes

Lead pipes are not recommended for water supply schemes, especially in soft water systems, because soft water dissolves lead, making the water toxic. The correct answer is E lead pipes.

2. Matching items

List A

i. A series of steps without a landing.
ii. The height between the lines of nosing to the soffit of ceiling or roof immediately above.
iii. The space in which the series of steps and landing are housed.
iv. The actual means of ascension or descension from one level to another.
v. The member that connects the nosing of all treads in any series of steps.
vi. An inclined member at a convenient height projecting above steps of stair to provide assistance and safe guard to users.
vii. The member receiving the ends of steps which are generally housed to the inclined support and secured by wedges.
viii. The vertical member between two consecutive treads.
ix. The vertical member between two consecutive treads.
x. The step of non-uniform width.

List B

A. head room
B. flier
C. soffit

D. going
E. stringer
F. baluster
G. stairs
H. rise
I. winder
J. flight
K. stairwell
L. hand rail
M. pitch line
N. riser
O. landing

i - J flight
ii - A head room
iii - K stairwell
iv - G stairs
v - D going
vi - L hand rail
vii - E stringer
viii - N riser
ix - F baluster
x - I winder

3. (a) Define the following terms:

(i) Slump test

The slump test is a method used to measure the workability or consistency of fresh concrete. It determines how easily concrete flows and is used to check the uniformity of batches in construction. The test involves filling a slump cone with fresh concrete, compacting it, and then lifting the cone to observe how much the concrete slumps or collapses. A high slump indicates a very fluid mix, while a low slump suggests a dry mix.

(ii) Cube test

The cube test is a method used to assess the compressive strength of concrete. It involves casting concrete into standard cube-shaped molds, curing them under controlled conditions, and then applying pressure to the cubes using a compression testing machine. The results determine whether the concrete meets the required strength for structural use.

(b) Briefly explain the importance of curing a concrete.

Curing is the process of maintaining adequate moisture, temperature, and time conditions to allow concrete to gain strength and durability. Its importance includes:

- Preventing rapid moisture loss, which can lead to surface cracks.
- Enhancing the hydration process, which improves concrete strength.
- Increasing durability by reducing the risk of shrinkage and cracking.
- Improving resistance to weather conditions, chemicals, and wear.

4. (a) What is site reconnaissance?

Site reconnaissance is the preliminary investigation of a construction site to assess its suitability for a proposed project. It involves visual inspections, surveys, and basic observations of terrain, soil conditions, vegetation, water sources, accessibility, and environmental factors. The purpose is to gather essential information before detailed site exploration and planning.

(b) What is the objective of site exploration?

Site exploration aims to gather detailed information about the subsoil, groundwater conditions, and other geological features affecting construction. The objectives include:

- Determining the load-bearing capacity of the soil.
- Identifying potential foundation problems such as weak soil layers or underground water.
- Assessing the availability of construction materials such as sand, gravel, and stone.
- Ensuring the site meets environmental and legal requirements.

5. (a) Briefly explain the function of a footing or foundation wall.

A footing or foundation wall is a structural element that transfers the load of a building to the ground. Its functions include:

- Distributing the building load evenly to prevent settlement.
- Providing stability by resisting movement due to soil pressure or external forces.
- Protecting the structure from ground moisture and temperature changes.
- Serving as a base for walls and columns to prevent structural failure.

(b) State the difference between DPC and DPM in construction works.

DPC (Damp Proof Course) is a layer of waterproof material placed in walls or floors to prevent moisture from rising from the ground into a building. It is commonly made of materials like bitumen, plastic sheets, or cement mortar.

DPM (Damp Proof Membrane) is a flexible waterproof sheet, usually made of polyethylene, placed under concrete floors to prevent moisture from penetrating from the soil. It acts as a continuous barrier against ground dampness.

6. (a) What is a 'standard' in scaffolding?

A standard in scaffolding is a vertical tube or pole that supports the entire weight of the scaffold structure. It is placed at regular intervals to provide stability and distribute loads evenly from the platform to the ground or foundation.

(b) State the difference between transom and put log.

A transom is a horizontal scaffolding component that spans across the scaffold width, providing support to the working platform and strengthening the structure.

A putlog is a horizontal member that rests against a wall and supports scaffold boards. Unlike transoms, which span between standards, putlogs have one end resting in the scaffold and the other inserted into brickwork or an adjacent structure.

(c) Why is it important to provide guide rail in scaffolding?

Guide rails in scaffolding serve as safety barriers to prevent workers from falling off the platform. Their importance includes:

- Enhancing worker safety by preventing accidental falls.
- Providing hand support for workers moving along the scaffold.
- Meeting legal safety requirements for construction sites.
- Improving scaffold stability by adding extra support.

7. Give four parameters considered for the selection of site for dam construction.

- Geological stability – The site should have strong rock formations to support the dam structure.
- Availability of water – The site must have a sufficient and continuous water supply to justify dam construction.
- Environmental impact – The site should not cause significant harm to ecosystems, wildlife, or human settlements.
- Economic feasibility – The cost of construction, maintenance, and benefits of the dam should be carefully evaluated.

8. (a) Name four roof covering materials commonly used for pitched roofs.

- Galvanized iron sheets
- Clay or concrete tiles

- Thatch (grass or palm leaves)
- Asphalt shingles

(b) State four factors on which the selection of roofing material will depend upon.

- Climatic conditions – Roofing materials should withstand local weather conditions such as heavy rainfall, heat, or snow.
- Cost and availability – The material should be affordable and readily available in the region.
- Durability – Long-lasting materials reduce maintenance and replacement costs.
- Structural strength – The building must support the weight of the chosen roofing material.

9. (a) Why doors and windows are provided in the room of a building?

- To allow natural light inside the building, reducing the need for artificial lighting.
- To facilitate ventilation by enabling air circulation.
- To provide access and movement between rooms or to the outside.
- To enhance security by allowing controlled entry and exit.

(b) What type of door do you suggest for bathrooms and dining rooms of modern residential buildings?

For bathrooms, a flush door with a waterproof finish or PVC door is ideal because it resists moisture and is easy to clean.

For dining rooms, a panel or glazed door is preferable as it provides an elegant appearance and allows light to pass through, creating a more spacious feel.

10. Describe the following types of hinges:

(a) Strap hinges

Strap hinges are long, decorative hinges with extended arms that are often used for heavy wooden doors, gates, and barn doors. They provide strong support and durability.

(b) Hook and band hinges

Hook and band hinges consist of a hook attached to a post or wall and a strap-like band connected to the door. This type of hinge is commonly used for large, heavy doors and gates as it allows for easy removal and reattachment.

11. Calculate the moisture content of a piece of timber 120cm long, 25mm x 150mm cross-section. It weighs 4000g before seasoning and 3000g after seasoning.

Moisture content (MC) is calculated using the formula:

MC = [(Initial weight - Final weight) / Final weight] × 100

MC = [(4000g - 3000g) / 3000g] × 100
MC = (1000 / 3000) × 100
MC = 33.33%

The moisture content of the timber is 33.33%.

12. State four properties of concrete.

- Compressive strength – Concrete has high resistance to compressive forces, making it suitable for structural applications.
- Durability – It withstands weather conditions, wear, and chemical exposure over time.
- Workability – Fresh concrete can be molded into different shapes before it hardens.
- Fire resistance – Concrete is non-combustible and provides good fire protection for buildings.

13. (a) (i) Name four functional requirements of a good wall.

- Strength and stability – The wall must be strong enough to support the loads acting on it, including self-weight, roof load, and any imposed forces.
- Weather resistance – The wall should be capable of resisting wind, rain, and temperature changes without deteriorating.
- Fire resistance – The wall should be made of materials that prevent or slow down the spread of fire.
- Thermal and sound insulation – The wall should provide adequate insulation to maintain comfortable indoor temperatures and reduce noise transmission.

(ii) Name two instruments/equipment used for setting out the circular walls.

- Theodolite – Used for measuring angles and setting out curved structures with precision.
- Pegs and strings – Used to mark the layout of the circular structure on the ground before construction begins.

(b) (i) Differentiate between sleeper wall and cavity wall.

A sleeper wall is a low wall constructed to support floor joists in buildings with suspended timber flooring. It is usually built in the basement or crawl space to provide intermediate support.

A cavity wall consists of two parallel walls (an inner and outer leaf) with a gap or cavity in between. The cavity acts as an insulation barrier against moisture and heat transfer, improving thermal efficiency and reducing dampness.

(ii) State the function of a parapet wall.

A parapet wall is a low protective barrier built at the edge of a roof, balcony, or terrace. Its functions include:

- Preventing people from falling off elevated surfaces.
- Providing protection against strong winds.
- Enhancing the aesthetics of the building.
- Concealing rooftop equipment such as water tanks or HVAC systems.

(c) Define the terms ‘corbel’ and ‘coping’ as applied in building construction.

- Corbel – A corbel is a projection of masonry or concrete that extends from a wall to support weight above, such as a beam, arch, or balcony. It is commonly used in decorative and structural applications.
- Coping – Coping is the protective covering or cap placed on top of a wall to prevent water infiltration. It helps direct rainwater away from the structure, protecting the wall from erosion and dampness.

(d) Aided with a neat sketch, differentiate between weathering and throating.

- Weathering – The process of shaping and sloping external surfaces, such as coping stones, to allow rainwater to drain away from the wall and prevent water penetration.
- Throating – A groove or undercut formed at the bottom of coping, window sills, or cornices to prevent rainwater from dripping onto the wall surface, reducing water damage.

14. Briefly describe the construction of the following types of floors.

(a) Glass flooring

Glass flooring is a type of flooring made using thick, toughened glass panels. The construction process includes:

- Preparing a strong supporting framework, usually made of steel or reinforced concrete.
- Placing the toughened glass panels securely within the framework.
- Sealing the joints between glass panels with silicone or other waterproofing materials.
- Adding anti-slip coatings to enhance safety.

(b) Mosaic flooring

Mosaic flooring is made using small, colored tiles arranged in artistic patterns. The construction steps include:

- Preparing a smooth concrete base as a subfloor.
- Spreading a layer of cement mortar to hold the tiles in place.
- Arranging the mosaic tiles in the desired pattern and pressing them into the mortar.

- Grouting the spaces between tiles and polishing the surface for a smooth finish.

(c) Industrial flooring

Industrial flooring is designed to withstand heavy loads, machinery, and chemical exposure. Its construction involves:

- Laying a reinforced concrete base for strength.
- Applying epoxy, polyurethane, or other hard-wearing coatings to protect against wear and chemicals.
- Ensuring a non-slip finish for worker safety.

(d) Field flooring

Field flooring refers to natural ground surfaces used for sports or agricultural activities. Its construction includes:

- Leveling and compacting the ground.
- Installing grass, synthetic turf, or compacted soil as the playing surface.
- Adding drainage systems to prevent waterlogging.

(e) Timber flooring

Timber flooring consists of wooden planks or boards used for flooring in buildings. The construction process includes:

- Installing sleeper joists or plywood subfloor for support.
- Laying and fixing timber planks using nails or adhesives.
- Sanding and finishing the surface with varnish or polish for durability and aesthetics.

15. (a) The main cause of foundation failure is unequal settlement of the subsoil. Explain three remedial measures to be taken in order to avoid it.

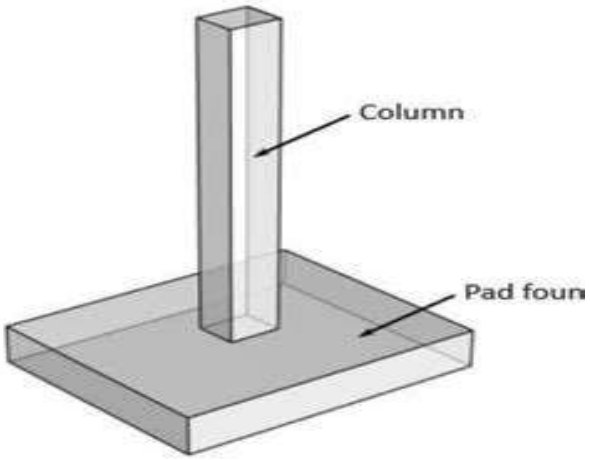
- Proper site investigation – Conduct soil testing and site exploration to determine soil type and its load-bearing capacity before construction.
- Using deep foundations – In areas with weak soil, deep foundations such as piles or piers should be used to transfer the load to a stronger soil layer.
- Ensuring uniform loading – The structure should be designed to distribute loads evenly across the foundation to prevent differential settlement.

(b) With the aid of a neat sketch, explain the precautions which must be observed when excavating a trench near an existing building.

- Providing temporary shoring to support trench walls and prevent collapse.

- Maintaining a safe distance from the existing foundation to avoid undermining its stability.
- Using step-cut or sloped trenches to reduce soil pressure on adjacent structures.
- Monitoring ground movement and vibrations to prevent structural damage.

(c) With the aid of a sketch, briefly explain the pad foundation.



A pad foundation is a type of shallow foundation that supports and distributes the load of a single point load, such as a structural column, to the ground. It consists of a concrete block, typically square, rectangular, or circular in shape, placed beneath the load-bearing element. The primary purpose of a pad foundation is to spread the load over a sufficient area of soil to prevent excessive settlement or bearing capacity failure.

Key Features of Pad Foundations:

- Shape and Size: The plan shape of pad foundations can be square, rectangular, or circular, chosen based on the nature of the applied load and the allowable bearing capacity of the soil. The size is determined to ensure that the load is adequately spread over the soil to prevent overstressing.

- Thickness: The thickness of the pad must be sufficient to distribute the load without causing shear failure or excessive bending. In reinforced concrete pads, the thickness is designed to accommodate the necessary reinforcement and to resist bending moments.

- Reinforcement: While plain concrete pads may be used for light loads and strong soil conditions, reinforced concrete pads are common, especially where higher loads or less favorable soil conditions exist. Reinforcement helps control cracking and allows the pad to accommodate tensile stresses.

Construction Considerations:

- Soil Assessment: Before designing a pad foundation, it is essential to assess the soil's bearing capacity to ensure it can support the imposed loads.

- Load Evaluation: Understanding the magnitude and distribution of loads from the structure helps in designing an appropriately sized and reinforced pad.

- Depth of Foundation: Pad foundations are typically placed at a shallow depth where suitable bearing strata are present. However, the depth must be sufficient to protect against frost action and seasonal moisture variations.