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: 2011**

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. The following are properties of hardened concrete, except

A durability
B curability
C impermeability to water
D strength
E resistance to friction

The correct answer is B curability because hardened concrete does not have a property known as curability. The primary properties of hardened concrete include durability, strength, impermeability, and resistance to friction.

II. Before preparing foundations for different structures, investigation should be done to determine

A irregularities in topography
B ground erosions
C ditches and flat grounds
D characteristics of the underlying materials
E streams and rivers near the site

The correct answer is D characteristics of the underlying materials because understanding the soil properties, bearing capacity, and stability of the subsoil is crucial before construction.

III. In cantilever or beam slabs, where steel should be placed

A at the bottom of each concrete unit
B at the center of each concrete unit
C at the topmost part of each concrete unit
D at any point within the concrete
E at all intermediate supports

The correct answer is C at the topmost part of each concrete unit because in a cantilever beam, the top surface experiences tensile stress, so reinforcement should be placed there to resist bending.

IV. If a brick is cut longitudinally, the pieces obtained are known as

A half bat
B queen closer
C mitred closer
D king closer
E beveled bat

The correct answer is B queen closer because a queen closer is a brick cut longitudinally to form two equal halves.

V. The objective of a roofing felt is to

A prevent the effect of rain
B prevent the effect of dust and the wind
C prevent excessive heat loss in winter
D keep the interior of the building cool
E avoid glare during construction

The correct answer is A prevent the effect of rain because roofing felt is a waterproof material used to provide an additional barrier against moisture penetration.

VI. A newly constructed building is finally handed over to the owner by the

A architect
B building inspector
C quantity surveyor
D contractor
E site foreman

The correct answer is D contractor because the contractor is responsible for completing the project and handing it over to the owner after ensuring all construction work has been carried out according to the contract specifications.

VII. The ground unevenness caused by settlement may be due to

A expansion of soil carrying the building loads
B seasonal volume changes in the soil
C unstable ground underneath excavations
D attachment in rocky sites
E felling of trees near the buildings

The correct answer is C unstable ground underneath excavations because settlement often occurs when the underlying soil is weak or has been disturbed due to excavation work, leading to uneven ground levels.

VIII. A flying shore has the advantage that it

A prevents people from passing under the structure
B terminates the arrangement of shoring to the wall
C enables enough space to be occupied by the shoring system
D helps to reduce the labour working costs

E provides a clear working space under the shoring

The correct answer is E provides a clear working space under the shoring because flying shores are used when excavation prevents raking shores, allowing free movement beneath the supported structure.

IX. In drainage works, where an excavation of a trench is done within 900 mm from the existing building, the refill must be in concrete up to

A the underside of the existing foundations
B the top of the existing foundation
C 190 mm below the underside of the existing structure
D 150 mm above the top of the existing foundation
E 150 mm below the foundation of the existing structure

The correct answer is A the underside of the existing foundations because refilling with concrete up to the foundation's underside provides stability and prevents settlement or collapse.

X. During timbering to trenches in compact soils, the ceiling boards are placed

A diagonally across the trench sides
B horizontally against the sides of the trench
C diagonally across the width of the trench
D vertically against the sides of excavation
E diagonally against the wall bearing end

The correct answer is B horizontally against the sides of the trench because in compact soils, horizontal timbering prevents soil collapse while allowing for proper trench support.

2. Matching items

List A

i. Thin vertical supports for the handrail to open stairs
ii. The total horizontal length of a stair, including the platform
iii. Horizontal surface member of each step in a stair
iv. The floor at either the top or bottom of a flight of stairs
v. The main post of the railing at the bottom of a stair
vi. Enclosed chamber into which the treads are built
vii. Horizontal distance of each step in a stair
viii. The total floor-to-floor vertical height of a stair
ix. Vertical face of the step in a stair
x. Vertical distance of the step in a stair

List B

A. Newel
B. Tread
C. Rise
D. Going
E. Baluster
F. Winder
G. Stairwell
H. Headroom
I. Landing
J. Riser
K. Balustrade
L. Handrail
M. Stringer
N. Step

Answers:
i - E Baluster
ii - D Going
iii - B Tread
iv - I Landing
v - A Newel
vi - G Stairwell
vii - D Going
viii - H Headroom
ix - J Riser
x - C Rise

3. (a) What is meant by "clearing the site"?

Clearing the site refers to the process of preparing a construction area by removing all obstacles such as vegetation, debris, old structures, and topsoil to ensure a level ground surface suitable for construction. This process helps in providing a stable foundation and reduces potential hazards during construction.

(b) State three different ways in which the right angle may be used during setting-out on site.

i. Establishing perpendicular reference lines for accurate positioning of foundations and walls.
ii. Ensuring that corners of buildings and structures form 90-degree angles for proper alignment.
iii. Checking the squareness of formwork and other structural components to maintain accuracy.

4. Outline four main factors to be considered when laying copings on parapet walls.

i. Weather resistance – Copings should be designed to protect the wall from water penetration.
ii. Material durability – Copings should be made from durable materials like concrete, stone, or metal to withstand external forces.
iii. Slope design – Copings should have a slight slope to allow water drainage away from the wall.
iv. Proper fixing – Secure fixing with mortar or mechanical fasteners to prevent displacement due to wind or movement.

5. (a) What is "Primary flow" in a hot water supply system?

Primary flow refers to the movement of heated water from the boiler or heating source to the hot water cylinder or distribution points before returning to the heating source. It forms a continuous loop that ensures a steady supply of hot water.

(b) Elaborate the purpose and advantages of using an indirect cylinder in hot water supply systems.

Purpose: An indirect cylinder is used to store and distribute hot water, which is heated by an external heat source such as a boiler through a coil system rather than direct immersion.

Advantages:
i. Prevents contamination by keeping the heating source separate from the water supply.
ii. Reduces energy consumption as heat can be retained efficiently within the system.
iii. Ensures a consistent hot water supply without direct contact between the heat source and the water.

6. (a) What are the following in arch construction?

(i) Facing a centre – The process of aligning the temporary wooden framework (centre) used to support an arch until it is self-supporting.

(ii) Striking a centre – The removal of the temporary support (centre) after the arch has gained sufficient strength to support itself.

(b) Outline four factors considered when deciding on the method to be employed in the construction of an arch.

i. Type of materials – The choice between brick, stone, or concrete affects the construction method.
ii. Load-bearing capacity – The structural design should consider the expected loads on the arch.
iii. Span length – Longer spans require more robust centering and support.
iv. Aesthetic requirements – Some methods may be preferred for decorative purposes in certain architectural designs.

7. (a) Mention three types of casement windows in a residential building.

i. Side-hung casement window.
ii. Top-hung casement window.
iii. Bottom-hung casement window.

(b) List four types of ironmongery used in fixing casement windows.

i. Hinges.
ii. Stays.
iii. Fasteners.
iv. Handles.

8. Explain briefly the main risk of brick chimney stacks and suggest means to overcome the possible effects by the fireplace.

Main risk: Brick chimney stacks are prone to cracking and collapsing due to heat expansion, high winds, and structural settlement, which can lead to fire hazards and instability.

Solutions:
i. Regular maintenance and inspection to detect early signs of damage.
ii. Reinforcing the chimney with steel rods or lining it with fire-resistant materials.
iii. Using expansion joints to accommodate thermal movement.
iv. Ensuring proper flashing and waterproofing to prevent moisture damage.

9. State four advantages of steel formwork.

i. Durability – Steel formwork lasts longer than timber and does not warp or shrink.
ii. Reusability – It can be used multiple times, reducing construction costs.
iii. Precision – Provides a smooth and uniform concrete finish.
iv. Strength – Can withstand high pressure from wet concrete without deformation.

10. (a) Give four factors that affect the workability of concrete.

i. Water-cement ratio – More water increases workability but weakens the concrete.
ii. Aggregate size and shape – Smooth and rounded aggregates improve workability.
iii. Mixing method – Proper mixing ensures uniform consistency.
iv. Admixtures – Chemical additives can enhance workability without affecting strength.

(b) Explain the reason for steel to be cranked in continuous beams.

Cranking steel in continuous beams helps to provide extra reinforcement at points of high tensile stress, especially in areas where the beam undergoes bending. This ensures structural integrity by reducing the risk of cracking and failure.

11. State four properties that make hardwood a suitable construction material.

i. High density – Provides strength and durability.
ii. Resistance to decay – Less prone to insect attacks and rot.
iii. Excellent finish – Can be polished or stained for aesthetic purposes.
iv. Fire resistance – Certain hardwoods have better fire resistance than softwoods.

12. With the aid of sketches, distinguish a shallow stair from a steep stair.

A shallow stair has a lower rise and a longer going, making it easier to ascend and descend. A steep stair has a higher rise with a shorter going, requiring more effort to use.

13. Soil tests on a certain site revealed that the soil has poor bearing capacity. Suggest three suitable types of foundation for a building to be erected on this site.

i. Raft foundation – Spreads the load over a large area, reducing pressure on weak soil.
ii. Pile foundation – Transfers the load to deeper, more stable soil layers.
iii. Strip foundation with reinforced concrete – Distributes weight along a continuous base to enhance stability.

14. A brick pier 0.45m x 0.45m exerts a force of 200 kN, including the mass of the pier.

(a) Calculate the pressure per m^2 on the brick pier.

Pressure = Force / Area
= 200 kN / (0.45 × 0.45) m^2
= 200 / 0.2025
= 987.65 kN/m^2

(b) Calculate the minimum area of foundation required if the soil has a bearing capacity of 150 kN/m^2.

Minimum area = Force / Bearing capacity
= 200 / 150
= 1.33 m^2
13. (c) With the aid of sketches, explain the structural construction of the following:

(i) Lean-to roof
A lean-to roof is a simple type of sloped roof that rests against a higher wall. It consists of rafters supported on one side by a wall and on the other side by a beam or post. This roof type is commonly used for extensions, porches, and sheds.

(ii) Couple roof

A couple roof consists of two sloping rafters that meet at the ridge, forming an A-shape. The bottom ends of the rafters are secured to the walls, and no horizontal support like a tie beam is used, making it suitable for small spans.

(iii) Timber flat roof
A timber flat roof consists of horizontal timber joists supported by load-bearing walls. The joists are covered with plywood or boards, followed by a waterproofing layer to prevent water penetration. This type of roof is commonly used for modern residential and commercial buildings.

14. (a) State five places suitable for constructing a manhole or an inspection chamber along a drain.

i. At junctions where two or more drains meet.
ii. At changes in direction of the drainage system.
iii. At intervals along long drainage runs for maintenance access.
iv. At changes in gradient to manage flow adjustments.
v. At entry points to main sewer lines for easy access and monitoring.

(b) Explain briefly the following methods of testing a drain before use:

(i) Air test
An air test involves sealing the ends of a drain pipe and applying air pressure inside. A pressure gauge measures any loss of air pressure, which indicates leaks or defects in the pipe.

(ii) Smoke test
A smoke test involves introducing non-toxic smoke into the drain system and observing for any leakage points where smoke escapes. This method helps in identifying cracks or improperly sealed joints.

(iii) Ball test
A ball test uses a round ball, slightly smaller than the pipe diameter, which is passed through the drain to check for blockages or obstructions that may hinder proper flow.

(iv) Water test
A water test involves filling the drain with water up to a specific level and checking for any loss of water. If the water level drops, it indicates a leakage in the system.

(c) With the aid of a sketch, explain briefly about the construction of a soak-away pit as related to its functions.

A soak-away pit is an underground structure designed to collect and disperse wastewater or stormwater into the surrounding soil. It consists of a perforated chamber or gravel-filled pit that allows water to percolate through the ground, preventing surface water accumulation and reducing flood risk.

15. (a) A deep foundation is to be excavated in loose soil that is waterlogged. With the aid of simple sketches, explain three possible ways of dewatering the soil to allow the excavation work to proceed.

i. Wellpoint system – Small-diameter pipes with suction pumps are used to lower the water table around the excavation site.
ii. Sump pumping – A pit (sump) is created to collect water, which is then pumped out using a submersible pump.
iii. Electro-osmosis – An electric field is applied to draw water away from the excavation area, improving soil stability.

(b) A concrete slab of 130 mm thick, with a length of 12000 mm and width of 3000 mm, is to be cast from concrete with a mix ratio of 1:3:6. Calculate:

(i) The volume of the concrete slab

Volume = Length × Width × Thickness
= 12 × 3 × 0.13
= 4.68 m^3

(ii) The number of bags of cement required for the work if a bag of cement (50 kg) has a volume of 0.04 m^3

Total mix ratio = 1 + 3 + 6 = 10 parts
Cement volume = (1/10) × 4.68
= 0.468 m^3
Number of bags = 0.468 / 0.04
= 11.7 ≈ 12 bags

(iii) The quantities of fine aggregate and coarse aggregate required

Fine aggregate (sand) volume = (3/10) × 4.68
= 1.404 m^3

Coarse aggregate volume = (6/10) × 4.68
= 2.808 m^3

(c) If the water-cement ratio is 0.5, calculate the amount of water required.

Water volume = 0.5 × Cement volume
= 0.5 × 0.468
= 0.234 m^3 or 234 liters