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: 2012**

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.

1. I. The central vertical member of a traditional casement window is known as
A stile
B sill
C transom
D mullion
E bottom rail

The correct answer is D mullion because a mullion is the central vertical structural element that divides window sections.

II. A pipe conveying water from a storage cistern is called
A service pipe
B distribution pipe
C communication pipe
D main pipe
E rising main

The correct answer is E rising main because it is the pipe that carries water from a storage tank to distribution points in a building.

III. The following are types of subsoil except
A gravel
B sand
C silt
D clay
E rocks

The correct answer is C silt because silt is classified as fine-grained sediment rather than a subsoil type.

IV. Which of the following is not a load-bearing wall?
A Fender
B Retaining
C Sleeper
D Panel
E Separating

The correct answer is D panel because panel walls are lightweight and do not support structural loads.

V. Which of the following is a list of building materials with flooring materials only?
A Concrete, timber, zinc, and polythene
B Marble, linoleum, asphalt, and timber
C Linoleum, plastic tiles, cement, and lead
D Marble, thatch, asphalt, and cladding

E Timber, reinforcement rods, sand, and paint

The correct answer is B marble, linoleum, asphalt, and timber because these are commonly used flooring materials.

VI. The purpose of fixing architraves around door openings is to
A cover a joint between a frame and lining and wall
B locate the position of hinges in frames or linings
C provide a key for the plaster work
D attach door frames or linings to walls
E allow anchoring of the door to frames or linings

The correct answer is A cover a joint between a frame and lining and wall because architraves serve a decorative and functional purpose in concealing gaps.

VII. The liners are built in
A hearths to receive combustible materials
B chimney breasts to control circulation of air
C chimney pots to close the flue
D the fire back to facilitate reflections of heat
E fireplace recess to receive the fine black

The correct answer is B chimney breasts to control circulation of air because liners are used to enhance airflow and improve chimney efficiency.

VIII. Main reinforcement rods are placed in concrete beams at places where there is
A minimum tensile stress
B maximum tensile stress
C shearing failure
D maximum compressive stress
E neutral axis

The correct answer is B maximum tensile stress because reinforcement rods counteract tensile forces in concrete beams.

IX. The drainage pipe systems start receiving the flow from
A inspection chambers
B water taps
C sanitary appliances
D cold water cisterns
E water mains
The correct answer is C sanitary appliances because drainage pipes collect wastewater from sinks, toilets, and showers.

X. The type of roof which slopes in two directions with a break in the slope on each side is known as

A gable roof
B hip roof
C asymmetrically pitched roof
D mansard roof
E gambrel roof

The correct answer is D mansard roof because it has two slopes on each side, with the lower slope being steeper.

2. Matching items

List A

i. Commissions the building works
ii. Executes part of the works as assigned by the employer
iii. Certifies certificates for payments of the executed construction works
iv. Represents the main contractor to supervise the construction works
v. The owner of the building project
vi. Verifies variations executed on the construction site
vii. Represents the consulting engineer on the construction site
viii. Represents the project designer on the construction
ix. Provides details for lifts, gas systems, and air conditioning
x. Takes measurements of all site works for valuation purposes

List B

A Architect
B Quantity surveyor
C Town planner
D Resident engineer
E Site engineer
F Nominated sub-contractor
G Technician
H Clerk of works
I Client
J Water engineer
K Estimator
L Service engineer
M Contractor
N Domestic sub-contractor
O Draughtsman

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3. With the aid of sketches, illustrate the following building structures:

a. Axially loaded column
An axially loaded column carries a vertical load applied along the centerline of the column. The force is evenly distributed along the cross-section, minimizing bending moments.

b. Eccentrically loaded column
An eccentrically loaded column carries a vertical load applied away from the centerline. This causes bending moments in addition to axial forces, leading to additional stress on one side.

4. a. Outline the composition of mortar as a building material.
Mortar is composed of the following:
i. Cement – Acts as a binding material to hold sand and aggregates together.
ii. Sand – Provides bulk and prevents excessive shrinkage.
iii. Water – Activates cement and allows proper mixing and bonding.
iv. Lime (optional) – Improves workability and adhesion.

b. Briefly explain the preparation of three basic types of mortar.

i. Cement mortar – Made by mixing cement, sand, and water. It is strong and used for brickwork, plastering, and flooring.
ii. Lime mortar – Composed of lime, sand, and water. It has high workability and is used for restoration and historic buildings.
iii. Gauged mortar – A mixture of cement, lime, and sand to combine the advantages of both cement and lime mortars. It improves strength and workability.

5. Elaborate four methods employed in overcoming dampness in buildings.

i. Providing a damp-proof course (DPC) – A waterproof layer placed in walls and floors to prevent moisture penetration.

ii. Proper drainage system – Ensuring proper site drainage and sloping to direct water away from the building.
iii. Surface treatment – Using waterproof paints or sealants on external walls to resist moisture absorption.
iv. Ventilation and dehumidification – Allowing airflow to reduce condensation and prevent mold growth.

6. Explain four advantages of the cavity wall in building construction.

i. Better insulation – The air gap between the inner and outer walls reduces heat loss and enhances thermal comfort.
ii. Protection against dampness – The cavity prevents water from penetrating into the internal structure.
iii. Soundproofing – The air gap acts as a barrier, reducing noise transmission.
iv. Structural stability – Cavity walls provide enhanced strength while keeping the weight of the structure manageable.

7. State four requirements of a good formwork.

i. Strength – It should withstand the load of fresh concrete without deformation.
ii. Rigidity – Should not deflect or deform under pressure.
iii. Ease of removal – Should be easily removable without damaging the concrete.
iv. Reusability – Should be durable and reusable to reduce construction costs.

8. a. Differentiate a door frame from a door lining.

i. A door frame is the structural framework fixed in the wall opening to support the door. It is usually made of timber, metal, or composite materials.
ii. A door lining is a lightweight, non-structural frame used to cover the rough opening where a door is fitted, mainly for aesthetic purposes.

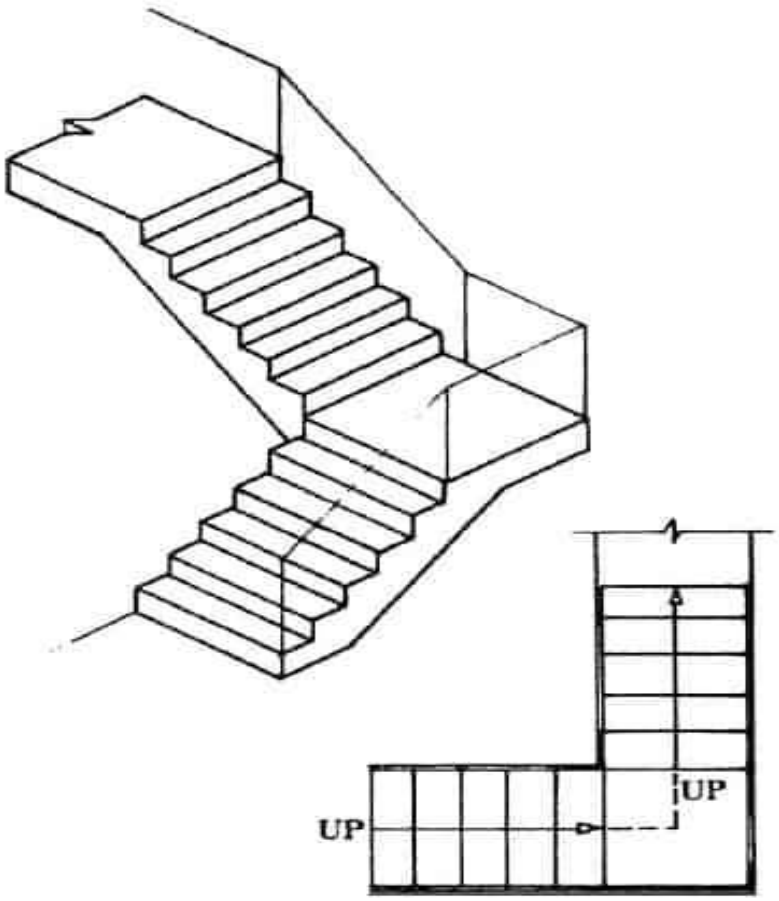
b. Where are door linings most suitably used as compared to door frames?

i. In interior spaces where structural strength is not a major concern.
ii. In lightweight partitions and drywalls.
iii. For aesthetic purposes in finished door openings.
9. a. Define a "stair."
A stair is a series of steps designed to provide access between different levels in a building. It consists of treads (horizontal steps) and risers (vertical components).
b. Draw a plan sketch of a quarter turn stair and label two parts.
A quarter-turn stair changes direction by 90 degrees, usually with a landing at the turning point.

In the plan view of a quarter-turn stair, two essential components are:

1. Landing: The flat platform where the direction changes, offering a resting point between the flights.

2. Flights: The series of steps between floors; in this case, two flights connected by the landing.



Quarter-turn Stair

10. Outline the steps of performing the "slump test" at the construction site and state its importance in construction.

i. Fill a standard slump cone with fresh concrete in three layers.
ii. Each layer is tamped 25 times with a standard rod.
iii. The cone is lifted vertically to allow concrete to slump under gravity.
iv. The decrease in height (slump) is measured.

Importance:
i. Ensures the concrete has the right workability for easy placement and compaction.
ii. Helps identify if the mix has the correct water-cement ratio.
iii. Detects any inconsistencies in the concrete mix before placement.

11. a. Define "timbering" as applied to the excavation of trenches.

Timbering refers to the practice of supporting trench walls using timber planks and struts to prevent soil collapse during excavation.

b. State two reasons for timbering in trenches.

i. To prevent trench walls from collapsing, ensuring worker safety.
ii. To provide stability in loose or waterlogged soil conditions.

12. Explain the following stair case terminologies:

a. A common stairway
A common stairway is a staircase shared by multiple users in a building, such as in apartments or public buildings.

b. A private stairway
A private stairway is a staircase used exclusively by occupants of a single house or section of a building.

13. a. Describe the following items as related to construction:

i. Granular soils – Soils made of coarse particles such as sand and gravel, which provide good drainage and stability.
ii. Cohesive soils – Fine-grained soils like clay that stick together, making them suitable for embankments but prone to shrinkage and swelling.
iii. Soil bearing capacity – The ability of soil to support structural loads without excessive settlement or failure.

b. A pad foundation occupies a ground area of 0.81 m^2 and is supporting a load of 162 KN. If the bearing capacity of the subsoil is 240 kN/m^2, show if the subsoil is suitable to support such a load.

Bearing pressure = Load / Area
= 162 kN / 0.81 m^2
= 200 kN/m^2

Since 200 kN/m^2 is less than the bearing capacity of 240 kN/m^2, the subsoil is suitable to support the load.

c. With the aid of sketches, distinguish between solid ground floor and a suspended concrete ground floor.

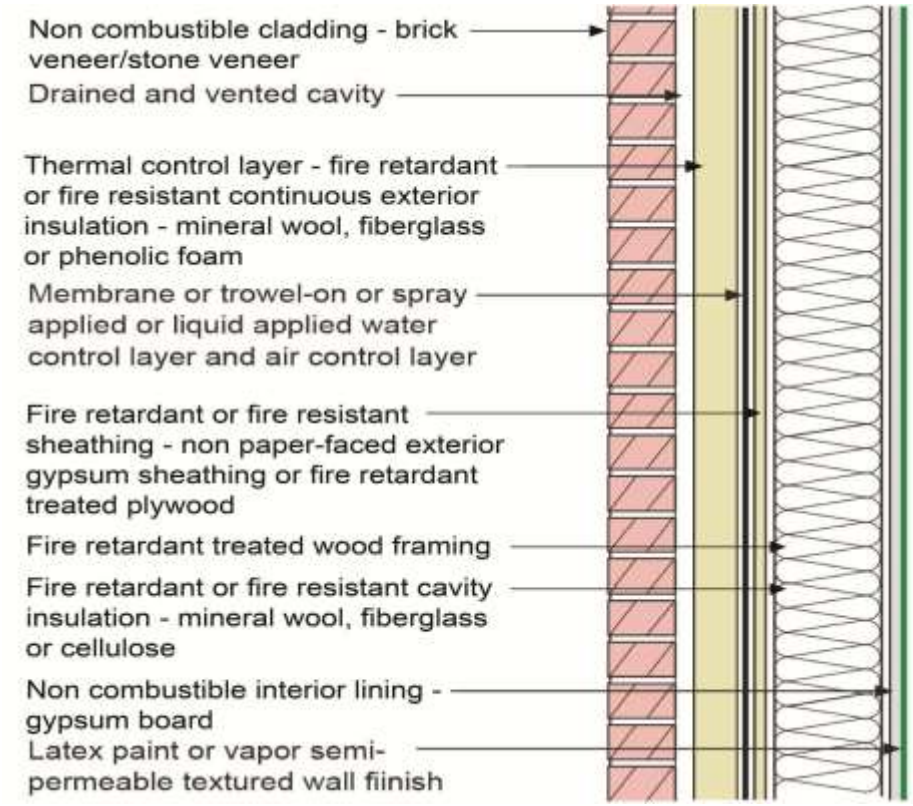
A solid ground floor rests directly on compacted soil or hardcore, while a suspended concrete floor is raised above the ground with voids beneath to prevent dampness.

d. Explain the advantage of a suspended concrete ground floor over a solid ground floor.

i. Prevents dampness by allowing ventilation beneath the floor.

ii. Reduces structural loads by minimizing direct contact with soil.
iii. Facilitates easy installation of services like plumbing and electrical conduits.

14. a. Sketch a part of a vertical section through the opening of a fireplace built to the external brick cavity wall and show six essential parts.



A fireplace integrated into an external brick cavity wall comprises several essential components that ensure its functionality and safety. Below is a description of these key parts:

- Chimney flue: A vertical passage that directs smoke and combustion gases from the firebox to the outside atmosphere, ensuring proper ventilation.

- Smoke chamber: Located above the firebox, this chamber funnels smoke from the firebox into the flue, aiding in efficient smoke expulsion.

- Damper: A movable plate situated within the throat of the fireplace that controls airflow, allowing the user to open it when the fireplace is in use and close it to prevent drafts when not in use.

- Firebox: The inner compartment where the fire is built, typically lined with fire-resistant materials to contain the heat safely.

- Hearth: The floor area within the firebox that extends outward into the room, providing a non-combustible surface in front of the fireplace.

- Cavity wall construction: The external wall structure consisting of two layers (inner and outer wythes) with a gap (cavity) between them, enhancing insulation and preventing moisture ingress.

b. Explain how a fireplace can facilitate ventilation in a room.

i. The chimney draws smoke and gases upward, preventing indoor air pollution.
ii. The flue ensures continuous airflow, enhancing oxygen supply for combustion.
iii. Vent openings allow fresh air circulation, preventing heat buildup.

c. Elaborate the necessary treatments to be done around the opening of a fireplace so as to allow smooth construction of the timber floor in the building.

i. Fireproof lining to prevent heat damage to nearby materials.
ii. Expansion joints to accommodate movement due to temperature changes.
iii. Proper insulation to protect wooden elements from heat exposure.

d. With the aid of a well-labeled sketch, show how the setting-out on sloping ground is carried out in short horizontal distances.

The sketch should show:
i. Benchmarks
ii. Step excavation method
iii. Leveling using horizontal platforms

e. Explain briefly how cement is manufactured.

i. Limestone and clay are crushed and mixed in specific proportions.
ii. The mixture is heated in a rotary kiln at 1400-1500°C to form clinker.
iii. Clinker is ground with gypsum to control setting time.
iv. The final product is stored and packed for distribution.

15. (a) A part of the fencing wall (cement-sand block) is measured above the plinth level and found to be 12 m long, 3 m high, and 230 mm thick.

(i) If the jointing mortar applied in stretcher bond is 10 mm, estimate the number of blocks required for the construction of the wall above plinth.

To estimate the number of blocks required:

- Assume the standard block size is 450 mm × 225 mm × 230 mm.
- The area of the wall = Length × Height = 12 × 3 = 36 m²
- The area of one block (including mortar joint) = 0.45 m × 0.225 m = 0.10125 m²
- Number of blocks = Total wall area / Area of one block
  = 36 / 0.10125
  = 355.56 ≈ 356 blocks

(ii) Calculate the labour cost of building the wall if the rate of laying each block is Tshs. 200/=.

Labour cost = Number of blocks × Cost per block
= 356 × 200
= Tshs. 71,200

(iii) Calculate the labour charge for plaster works if the rate for plastering one square metre is Tshs. 750/= excluding the top part of the wall.

- Plastering is applied to both sides of the wall.
- Plastering area = 2 × (12 × 3)
= 2 × 36
= 72 m²
- Labour charge = 72 × 750
= Tshs. 54,000

(iv) Calculate the number of bags of cement to be purchased for the work of plastering the wall, given that:

- The thickness of cement-sand plaster is 15 mm.
- The volume of a 50 kg bag of cement is 0.04 m³.
- The mixing ratio with sand is 1:4.

Step 1: Calculate the total plaster volume
Plastering volume = Plastering area × Thickness
= 72 × 0.015
= 1.08 m³

Step 2: Calculate the cement volume
Total parts in mix = 1+4 = 5
Cement volume = (1/5) × 1.08
= 0.216 m³

Step 3: Determine the number of cement bags
Number of bags = Cement volume / Volume per bag
= 0.216 / 0.04
= 5.4 ≈ 6 bags

(b) With the aid of single line sketches, differentiate direct cold water supply system from indirect cold water supply system in the residential house.

A direct cold water supply system connects all taps and appliances directly to the mains water supply. This system provides high water pressure but depends on the availability of municipal water supply.
An indirect cold water supply system stores water in a storage tank before distributing it to taps and appliances. This system provides a backup supply but may have lower pressure.

A proper sketch should illustrate:

- Direct system: Water from mains directly to outlets.
- Indirect system: Water from mains to a storage tank, then to outlets.