



CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE XXXX

INTERMEDIATE LEVEL

Subject Title	SURVEY, SOIL MECHANICS AND MATERIALS
Subject Code No.	5230
Paper No.	TWO

INSTRUCTIONS TO CANDIDATES

DURATION: THREE HOURS

Answer FOUR questions. Choose TWO questions in Section A and ONE Each in Sections B and C.

All questions carry equal marks.

The total marks for this paper is 100.

Precise answers should be given and where necessary support them with neat sketches.

Answers should be corrected to two decimal places. Take $\pi = 3.14$.

You are allowed to use a mathematical set and a non-programmable calculator.

You are reminded of the necessity for good English and orderly presentation in your answers.

SECTION A: MATERIAL**Question 1**

The PTA during their last general assembly adopted a project for the construction of a dining shade in your school. After the preliminary studies by a locally based company, the use of burnt bricks and stones were adopted for the walls and foundation respectively. Your professional technology teacher expects you to answer the following questions.

- Name two types of bricks used in civil engineering. (3 marks)
- State two methods by which the strength of a clay brick can be improved. (3 marks)
- Draw and indicate the following parts of a typical brick (bed, frog, header, stretcher and aris) (8 marks)
- Give four qualities of a good building stone..... (4 marks)
- With the aid of neat sketch show a way in which stones can be arranged in stone wall (label your drawing)..... (4 marks)
- In function of their constituents, differentiate between cement and gauge mortar..... (4 marks)

Question 2

As student on industrial internship in a building construction site for the realisation of a composite structure in stones, bricks and concrete, you have been posted to the bricks and mortar manufacturing plant and you have been asked by team leader to answer the following questions.

- Briefly explain the following properties of burnt bricks: size and shape, colour, texture and compactness, and hardness and soundness..... (6marks)
- Define the following rock types base on their geological formation: sedimentary rocks, igneous rocks, and metamorphic rocks..... (6 marks)
- Explain the following characteristics of a good building stone: appearance, strength, structure, and workability..... (7 marks)
- State the function of each of the following concrete constituents: cement, coarse aggregates, and water..... (6 marks)

Question 3

You have just been employed by a building construction enterprise realising the new market in your council area and have been posted to the reinforced concrete and mortar manufacturing plant. You have been asked by your team leader to answer the following questions

- Name any four classes of aggregates base on their shape..... (6 marks)
- Briefly explain the characteristics of the following types of steel: mild steel, high carbon steel and high tensile steel..... (6 marks)
- Name three types of mortar each base on: the type of binder and the application..... (6 marks)
- Outline the following fabrication procedures of cement mortar: Manual and Mechanical..... (7 marks)

SECTION B: SOIL MECHANICS**Question 4**

A sample of saturated clay was placed in a container and weighed. The weight was 6 N. The clay in its container was placed in an oven for 24 hours at 105°C. The weight reduced to a constant value of 5 N. The weight of the container is 1 N. If $G_s = 2.7$, $S_r = 1$, determine the

- Water content..... (5 marks)
- Void ratio $e = \frac{w_c \cdot G_s}{S_r}$ (5 marks)
- Bulk unit weight $\gamma = \frac{G_s \cdot w_c (1+w)}{1+e}$ (5 marks)
- Dry unit weight $\gamma_d = \left(\frac{G_s}{1+e}\right) \gamma_w$ (5 marks)
- Effective unit weight $\gamma' = \left(\frac{G_s-1}{1+e}\right)$ (5 marks)

Question 5

- a) Copy and complete the table below knowing that $\gamma_d = \frac{\gamma}{1+w}$ (12 marks)
- b) Plot the dry density – water content curve on a standard graph paper..... (9 marks)
- c) Deduce the maximum dry density and optimum water content..... (4 marks)

Water content (%)	6.2	8.1	9.8	11.5	12.3	13.2
Bulk Density (kN/m ³)	16.9	18.7	19.5	20.5	20.4	20.1
Dry Density (kN/m ³)						

SECTION C: SURVEYS**Question 6**

The table below is an extract of a field note book of a leveling operation of the natural state of the segment of a surface water drainage system to be constructed on the newly constructed secondary school in your municipality. You are expected to determine the various levels which shall serve as a basis for the excavation.

Back sight	Intermediate Sight	Foresight	Rise	Fall	Reduced Levels	Distance	Remarks
3.39					26.70		
	2.81						
	2.51						
	2.22						
2.61		1.88					Change point
	2.32						
	2.32						
		1.54					

- a) Define the following terms: line of collimation, benchmark, change point, foresight..... (6 marks)
- b) Copy and complete the table above to determine reduce levels of the staff positions..... (15 marks)
- c) Carryout all the necessary checks..... (4 marks)

Question 7

In order to find the rail levels of an existing railway, a point A was marked on the rail, then points at distances in multiples of 20 m from A and the following readings were taken:

- Back sight 3.39 m or O.B.M. 23.10:
 - Intermediate sights on A, A +20 and A +40 of 2.81, 2.51 and 2.22 respectively.
 - A + 60: change point: foresight = 1.88, back sight = 2.61. Intermediate sights on A + 80 and A + 100 are 2.32 and 1.92 respectively; and finally a foresight of 1.54 on A + 120, all being in meters.
- a) Complete appendix 2 with the above readings on the rise and fall system..... (10 marks)
- b) Calculate the reduced levels of the staff positions (use **appendix 1**)..... (15 marks)

Appendix 1

(This sheet shall be completed and inserted in the answer booklet)

BS	IS	FS	RISE	FALL	RL	DISTANCE	REMARKS
							O.B.M
							Change point

CHECKING:

KEY

IS: Intermediate sight

BS: Back sight

FS: Foresight

RL: Reduced level