2707/205
BUILDING CONSTRUCTION II,
CIVIL CONSTRUCTION AND
TRANSPORT ENGINEERING I
June/July 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN CIVIL ENGINEERING
MODULE II

BUILDING CONSTRUCTION II, CIVIL CONSTRUCTION
AND TRANSPORT ENGINEERING I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Scientific calculator.
*This paper consists of **EIGHT** questions in **THREE** sections; **A, B** and **C**.*
*Answer **FIVE** questions choosing **TWO** questions from section **A**, **TWO** questions from section **B** and **ONE** question from section **C**.*
All questions carry equal marks.
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 8 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

SECTION A: BUILDING CONSTRUCTION II

*Answer any **TWO** questions from this section.*

1. (a) Explain **five** requirements for the construction of upper floors. (10 marks)

   (b) (i) Explain the term "centering" as used in reinforced concrete upper floors.

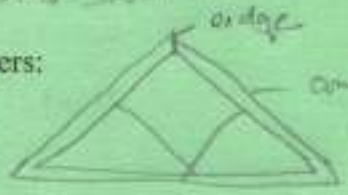
   (ii) Describe self-centering concrete floors. (4 marks)

   (c) With aid of a sketch, describe a hollow concrete beam floor. (6 marks)

2. (a) State **six** functional requirements of a roof. (6 marks)

   (b) (i) Describe the following timber roof members:

   (I) ridge;
   (II) common rafter.

   (ii) With the aid of a sketch, describe the following types of roofs:

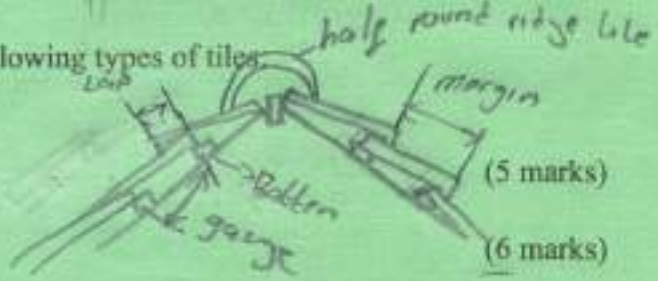
   (I) closed couple roof;
   (II) collar roof. (9 marks)

   (c) With the aid of sketches, describe the following types of tiles:

   (i) standard plain tile;
   (ii) half round ridge tile. (5 marks)

3. (a) Describe a slate as a roofing material. (6 marks)

   (b) Sketch each of the following timber connectors:

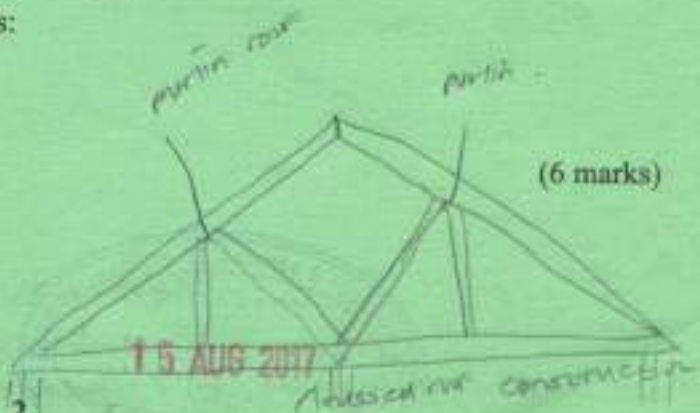
   (i) toothed plate timber connector;
   (ii) galvanised steel gang nail connector. (4 marks)

   (c) State **four** disadvantages of flat roofs. (4 marks)

   (d) Describe the following types of roofs:

   (i) purlin roof;

   (ii) trussed roof construction. (6 marks)

SECTION B: CIVIL ENGINEERING CONSTRUCTION

*Answer any **TWO** questions from this section.*

4. (a) (i) State **five** limit states which if exceeded may result in failure of retaining walls.

(ii) With aid of a sketch, explain the failure caused by the combination of a downward acting weight and an overturning moment on a retaining wall. (6 marks)

(b) State **four** functions of foundations. (4 marks)

(c) Outline **five** situations where pile foundations may be preferred. (5 marks)

(d) State **five** advantages of a tunnel. (5 marks)

5. (a) Describe the following water front structures:

(i) seawall;
(ii) breakwaters;
(iii) dolphin. (9 marks)

(b) (i) List **four** functions of a railway sleeper.
(ii) With aid of a sketch, describe a railway chair. (7 marks)

(c) Use sketches to illustrate the following methods of basement construction:

(i) retaining wall and raft;
(ii) piled basement. (4 marks)

6. (a) Explain each of the following:

(i) objective of a well development;
(ii) the completion of a sanitary well. (6 marks)

(b) Outline how each of the following factors influences the choice of a dam type:

(i) topography of the site;
(ii) availability of construction materials. (6 marks)

(c) With aid of a sketch, describe a hooded type siphon spillway. (6 marks)

(d) Describe a chute block as an auxillary device in a stilling basin. (2 marks)

SECTION C: TRANSPORT ENGINEERING I

*Answer **ONE** question from this section.*

7. (a) State **two** advantages of road transport over other transport systems. (2 marks)

(b) Outline **three** sources of funding for the planning and execution of transport systems. (6 marks)

(c) Differentiate between vertical alignment and horizontal alignment in road construction. (2 marks)

(d) Explain **three** factors that might influence the design of a transport system. (6 marks)

(e) Describe the following classifications of roads in Kenya:

(i) class A;

(ii) class B;

(iii) class C;

(iv) class D. (4 marks)

8. (a) Outline the design steps followed when using road note 29 Manual. (5 marks)

(b) Design a flexible pavement using the Kenyan design manual for the following conditions:

(i) **Subgrade:**

Alignment soil - black cotton soil for 1 m depth overlaying decomposed phenolite.

(ii) **CBR:**

(I) black cotton soil 2% to 5%;
(II) phenolite (decomposed) 10% - 20%.

(iii) **Traffic:**

Initial daily number of commercial vehicles and their equivalent factors:

(I) Buses 300 equivalent factor 1;
(II) Medium goods 280 equivalent factor 2;
(III) Heavy goods 295 equivalent factor 10.

(iv) **Design period:**

20 years with a constant annual growth rate of 4%.

(v) **Road Construction Materials:**

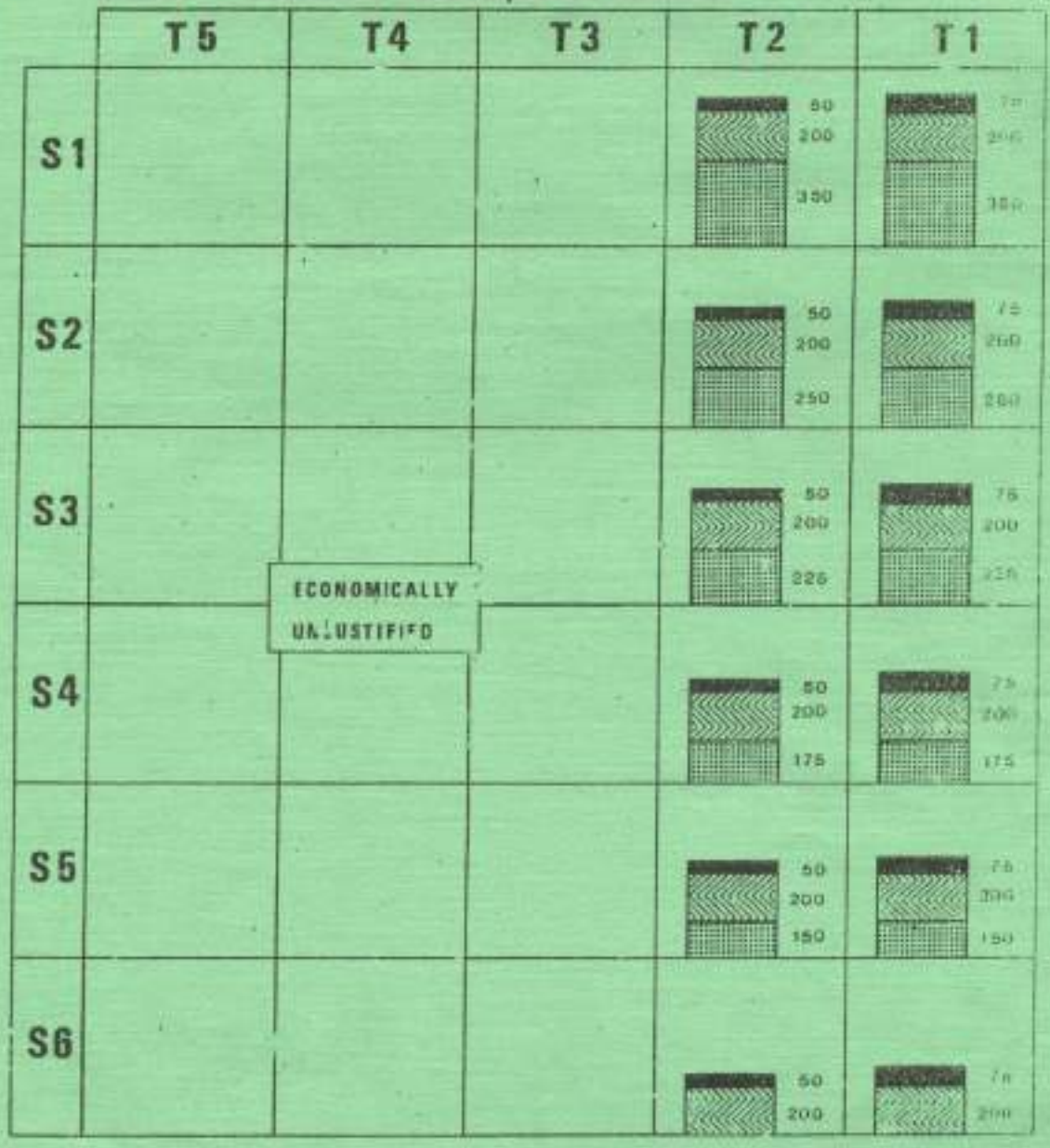
Field investigations and laboratory tests show that:

(I) there is stone suitable for asphalt concrete;
(II) dense bituminous, macadam and lean concrete is abundant;
(III) the stone may also be used as graded crushed stone sub base.

Use charts type 13, 14 and 15 attached. (15 marks)

STANDARD PAVEMENT STRUCTURE TYPES

BASE : Lean concrete
SUBBASE : Cement or lime improved material



SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10 ^{6}
S1	2 - 5	T1	25 - 80
S2	5 - 10	T2	10 - 25
S3	7 - 13	T3	3 - 10
S4	8 - 18	T4	1 - 3
S5	15 - 30	T5	0·25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table 9.3.1)

Native Subgrade Class		S1			S2			S3			S4
Improved Subgrade	Material	S2	S3	S4	S3	S4	S4	S5			
	Thickness (mm)	400	350	425	275	325	450	300	250	350	300	150	400
...ew Class		S2	S2	S3	S2	S3	S4	S3	S3	S4	S4	S4	...

STANDARD PAVEMENT STRUCTURE TYPE 14

BASE : Lean concrete
SUBBASE : Cement or lime improved material (Base quality)

	T5	T4	T3	T2	T1
S1				 50 / 150 / 325	 75 / 150 / 325
S2				 50 / 150 / 225	 75 / 150 / 225
S3		ECONOMICALLY UNJUSTIFIED		 50 / 150 / 200	 75 / 150 / 200
S4				 50 / 150 / 175	 75 / 150 / 175
S5				 50 / 150 / 150	 75 / 150 / 150
S6				SEE TYPE 13	

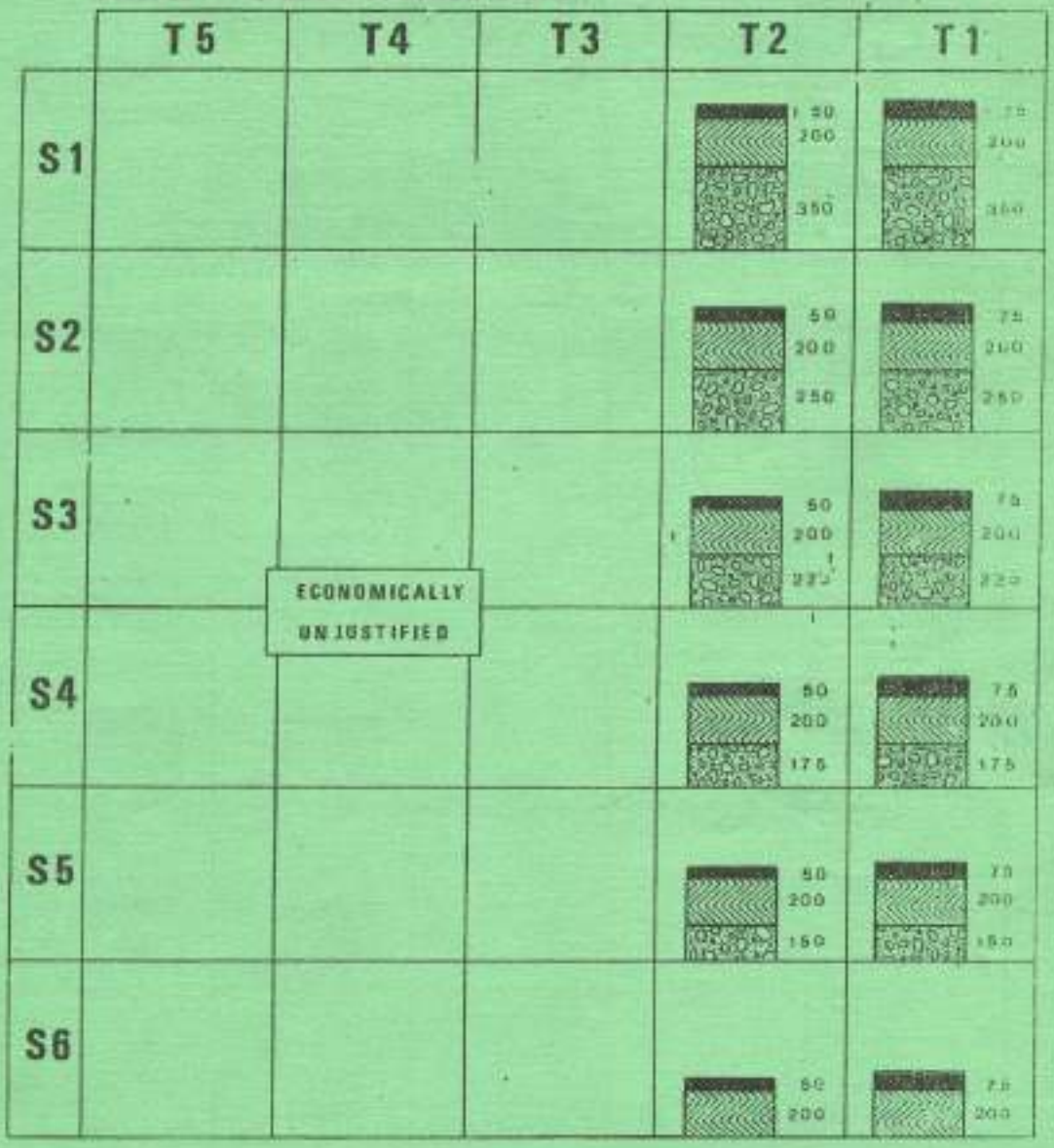
SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10^6
S1	2 - 5	T1	25 - 60
S2	5 - 10	T2	10 - 25
S3	7 - 13	T3	3 - 10
S4	10 - 18	T4	1 - 3
S5	15 - 30	T5	0·25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table 6.11)

Native Subgrade Class		S1						S2			S3		
Improved Subgrade	Material	S2	S3		S4			S3	S4		S4	S5	
	Thickness (mm)	400	250	425	275	325	450	300	200	150	300	150	450
New Class		S2	S2	S3	S2	S3	S4	S3	S3	S4	S4	S4	S5

STANDARD PAVEMENT STRUCTURE TYPES

BASE : Lean concrete
SUBBASE : Graded crushed stone



SUBGRADE		TRAFFIC	
CLASS	CBR (%)	CLASS	ESA x 10^6
S1	2 - 5	T1	25 - 60
S2	5 - 10	T2	10 - 26
S3	7 - 13	T3	3 - 10
S4	10 - 18	T4	1 - 3
S5	16 - 30	T5	0·25 - 1
S6	> 30		

IMPROVED SUBGRADE (Reproduced from Table 9.3.1)

Natural Subgrade Class		S1			S2			S3			S4		
Improved Subgrade	Material	S2	S3	S4				S3	S4		S4	S5	
	Thickness (mm)	400	150	425	275	325	450	200	250	350	300	150	150
New Class		S2	S2	S3	S2	S3	S4	S3	S3	S4	S3	S4	S5

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