NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

TRANSPORTATION ENGINEERING & PLANNING I

TCW 3105

Main Examinations paper

December 2015

This examination paper consists of 5 pages

Time Allowed: **3 Hours**

Total Marks: **100**

Examiner's Name: **T.C. Mdlongwa**

INSTRUCTIONS

1. Answer Question 2, Question 4 and any other 2 (two) questions.
2. Each question carries 25marks.
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
TOTAL	**100**

QUESTION 1

a) List the major disciplines of transportation engineering and briefly discuss each one of the disciplines.

[8marks]

b) Classify the different roles of transportation and discuss the importance of each.

[8marks]

c) Define the following terms in relation to transportation engineering:

i. Average daily traffic (ADT),
ii. Annual average daily traffic (AADT),
iii. Reaction Time,
iv. Right of Way (ROW), provide neat sketch.

[5marks]

d) Equally important as the consideration of horizontal alignment is that of the facility's vertical alignment. List at least four factors that influence the vertical alignment of highways.

[4marks]

QUESTION 2

a) The following VPI's are on a road:

VPI	SV (m)	Level (m)
1	330	141.8
2	720	158.6
3	1200	161.2

Given that curve length is 200m at VPI 5, calculate the levels on the curve at 50m intervals

[15marks]

b) A curving roadway has a design speed of 110 km/hr. At one horizontal curve, the superelevation has been set at 6.0% and the coefficient of side friction is found to be 0.10. Determine the minimum radius of the curve that will provide safe vehicle operation.

[5marks]

c) Distinguish between the terms mobility and accessibility citing appropriate examples in each case. Provide a sketch as part of your solution.

[5 marks]

QUESTION 3

a) Def the following:
   i. Trip generation,
   ii. Trip distribution,
   iii. Modal split,
   iv. Trip assignment.

[6marks]

b) Table 3.b.1 below represents an existing trip pattern and the growth in traffic for both the Origins and the Destinations. Applying the doubly constrained growth factor method to correct the base year matrix in order to satisfy the future year trip-end constraints.

t_{ij}		to			$\sum_j$	Target O_i
		A	B	C		
from	A	0	27	58	85	200
	B	35	0	31	66	150
	C	74	0	0	74	250
$\sum_i$		109	27	89	**225**	
Target D_j		300	200	100		**600**

[18marks]

c) What is the method applied in Question 3. b) known as?

[1marks]

QUESTION 4

a) What is a pavement?

[1mark]

b) What are the functions of a pavement?

[4marks]

c) Draw a typical flexible pavement structure and identify each layer which plays a role in carrying the traffic loads.

[5marks]

d) For a rural road located in Matabeleland North Province the following information is available for the design of a flexible pavement:

AADT	2400
Directional split (2-way DF)	50/50
Traffic Growth Rate	2%
Proportion of Heavy Vehicles	15%
Average Weight of Heavy Vehicle	1.5ESA's
Design life	15years
Subgrade Strength, CBR	3.5%
Lane distribution factor	1

For the given design parameters, determine the thickness of the granular layer to be provided above the subgrade [Assumption: A thin Hot Mix Asphalt surface course is to be provided and is assumed to be part of the granular layer].

[15marks]

QUESTION 5

a) List and define three sight distances as discussed during the lectures. Use sketches where necessary.

[7marks]

b) Show that the Stopping Sight Distance (SSD) on a sloped road is given by the equation

$$SSD = v \cdot t + \frac{v^2}{2g(f \pm G)}$$

Define each of the characters in the equations, giving their units of measurement.

[8marks]

c) A driver of a vehicle applied brakes and barely avoided hitting an obstacle, while driving along a flat section of a roadway. The vehicle left skid marks of 53m (Hint: skid marks indicating the distance moved in stopping vehicle in this scenario). Assuming *f=0.35*, determine whether the driver was in violation of the 60km/h speed limit at the location if he was travelling on level roadway.

[6marks]

d) Give at least four (4) considerations and factors influencing the horizontal and vertical alignment for a highway.

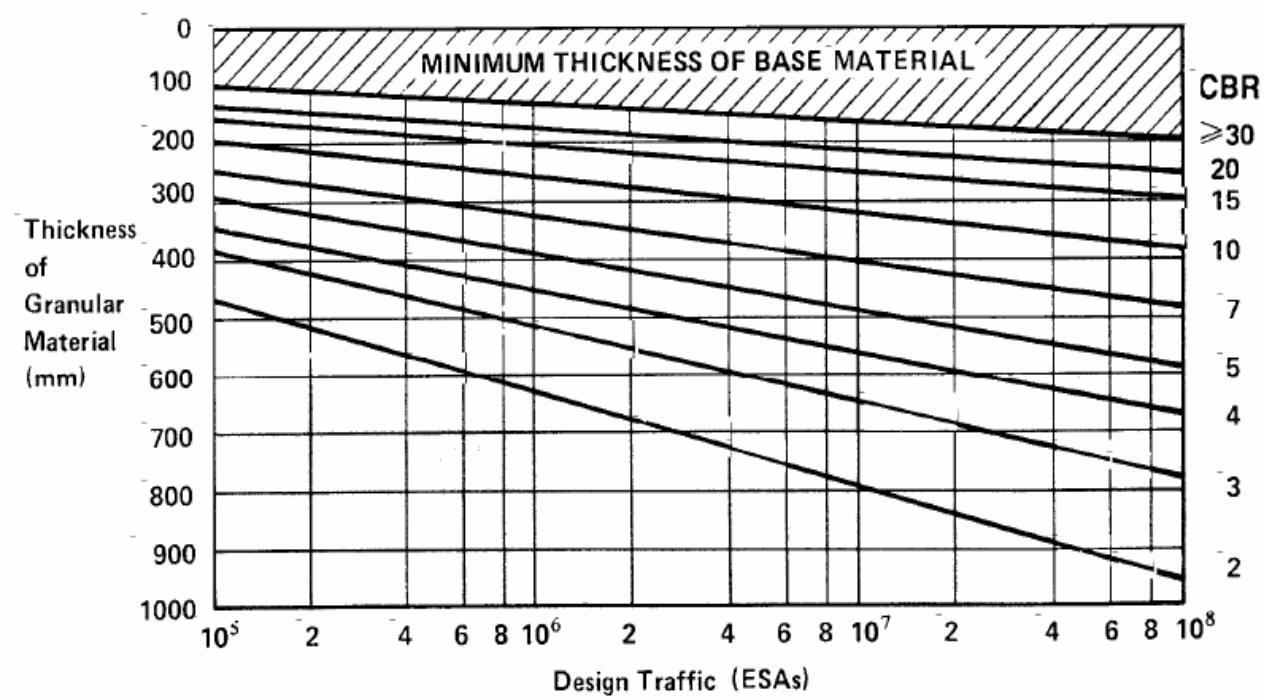
[4marks]

END OF EXAMINATION PAPER

INFORMATION FOR STUDENTS

$$N_{DT} = 365 \times AADT \times DF \times \%ageHV \times LDF \times CGF \times N_{HVAG}$$

$$CGF = \frac{(1 + 0.01R)^P - 1}{0.01R}$$



LIGHT TRAFFIC ROAD DESIGN CHART FOR GRANULAR PAVEMENTS WITH THIN BITUMINOUS SURFACING (Reproduced From Austroads "Pavement Design Guide",)