NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART II FIRST SEMESTER EXAMINATION – APRIL 2009
TRANSPORT ENGINEERING & PLANNING – TCW 3105

INSTRUCTIONS

Answer any four (4) questions. All questions carry equal marks.

Time : 3 hours
Total marks :100

QUESTION 1

(a) Calculate the tangent distance and length of circular curve for a road where the deflection angle is $11^{o}00'02"$ and the radius of curvature is 500m. **(4 marks)**

(b) For small deflection angles such as 5^{o}, why are minimum lengths of curve suggested? Given that the minimum length of 150m is suggested for a 5^{o} angle, what minimum length would you recommend for a 3^{o} deflection angle? **(3 marks)**

(c) What problems are caused by excessively long curves? **(2 marks)**

(d) Outline the main objectives of a traffic engineer in a traffic engineer management and control. **(16 marks)**

QUESTION 2

(a) Briefly describe the technique involved in conducting a number plate survey and state the type of situation where it is best suited as a means of traffic survey. **(5 marks)**

(b) In the following number plate systems, calculate the probability of the first four characters appearing on two different on the different vehicles. Assume that the letters I & O are not used as characters for all the systems:
(i) A342 BED
(ii) BJK 4822
(iii) NA 5632Z
(iv) 236499P (Note that the digit zero is not used as a first digit) **(12 marks)**
Give your answers as fractions in their lowest terms.

(c) Discuss the key advantage of self-completion forms as a method of traffic survey. **(8 marks)**

QUESTION 3

(a) Briefly describe a beat survey, stating its main objective as a means of traffic survey and also outlining the typical data that would be collected in this survey. **(6 marks)**

(b) Discussion the two major inaccuracies that arise in beat surveys and state two precautions that should always be taken before undertaking this type of survey. **(8 marks)**

(c) A vehicle is recorded three times in a beat survey where the surveyor's frequency of observation was 45 minutes. Estimate the vehicle's duration of stay. **(3 marks)**

(d) Define the following terms, in relation to traffic engineering:
(i) trip generation,
(ii) trip distribution,
(iii) modal split,
(iv) assignment. **(8 marks)**

QUESTION 4

(a) Distinguish clearly between the terms stopping sight distance, passing sight distance and meeting sight distance. **(9 marks)**

(b) Calculate the stopping sight distance (SSD) required for a vertical curve that is to be designed for a speed of 100 km/h where the reaction time is assumed to be 2.5 seconds, coefficient of friction is 0.38 and acceleration due to gravity is taken as $9.81 m/s^2$. **(6 marks)**

(c) For the same road with details given in part (b) above, where the gradients of the incoming and outgoing tangents of the vertical curve are +1.85% and 0.2% respectively and using the value you obtained in part (b), calculate the desirable length of vertical curve to be provided. **(10 marks)**

QUESTION 5

(a) Calculate the general cost of travel for a vehicle that operated for 8 hours and traveled 300km given that the time value of the vehicle is $1.00per hour, the vehicle operating cost is $0.40 per km and the other costs of travel are $4.00 **(3 marks)**

(b) For a road whose design speed is 90km/h and maximum rate of superelevation is 10%, show that the minimum radius of horizontal curvature to be provided, is approximately 270m. **(5marks**

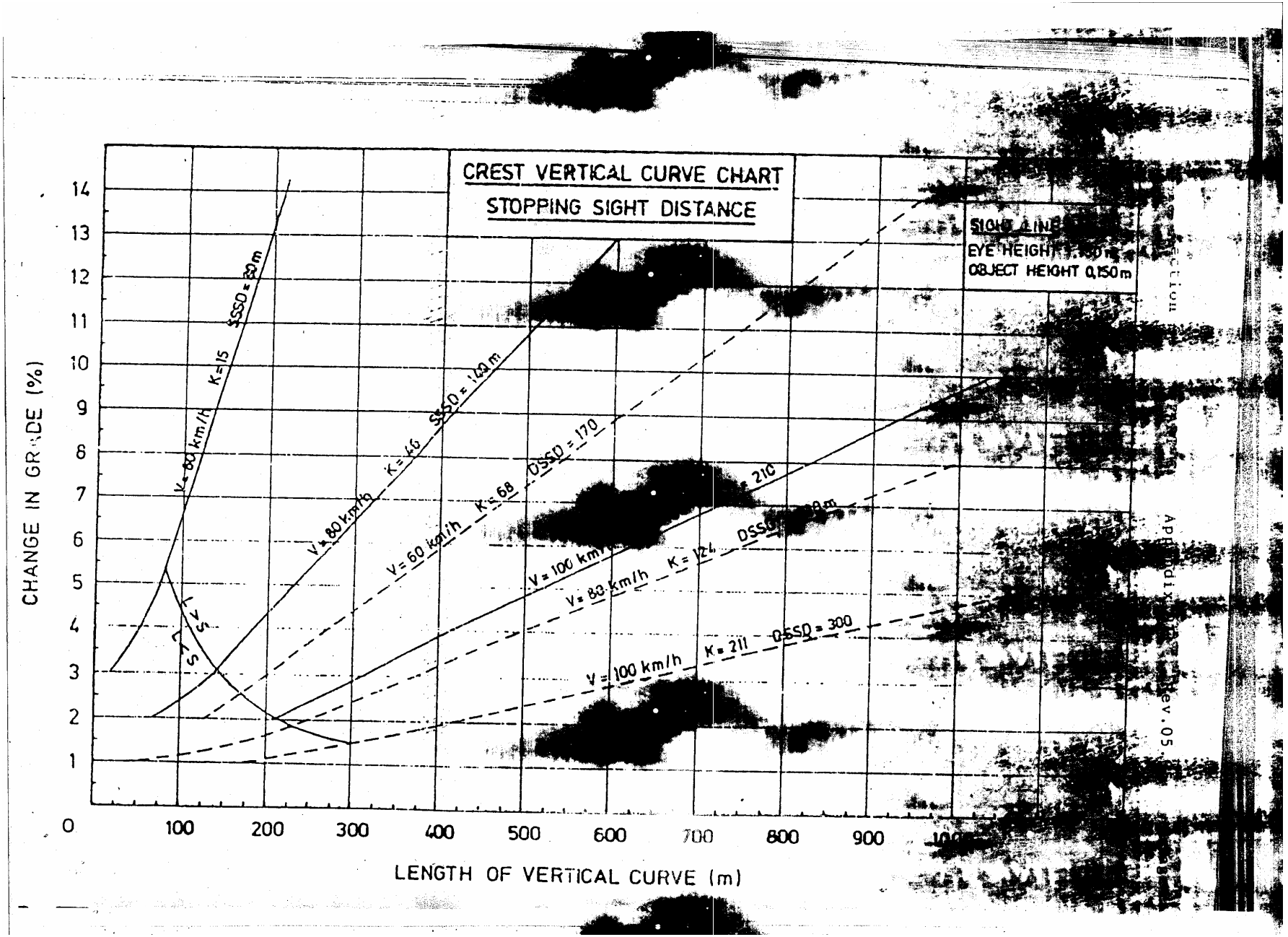
(c) Calculate the extra width required on a two lane curve of radius 150m which is designed to accommodate a vehicle with wheelbase of 5.5m traveling at a design speed of 60km/h. **(7 marks)**

(d) A vertical parabolic curve has been designed along the profile of proposed road to begin at 1 + 160 (km + m) peg where the reduced level is 1414.380m above mean sea level. The gradients of the incoming tangent and outgoing tangents are -0.40% and -0.853% respectively. If the curve is to be 20m long, calculate the reduced levels at the following chainages:

(i) 1 + 170 (km + m)

(ii) 1 + 175 (km + m)

(iii) end of vertical curve. **(10 marks)**


CREST VERTICAL CURVE CHART
STOPPING SIGHT DISTANCE
EYE HEIGHT 1.050m
OBJECT HEIGHT 0.150m
V = 80 km/h K=15 SSSD = 80m
V = 80 km/h K=46 SSSD = 140m
V = 60 km/h K=68 OSSD = 170
V = 100 km/h K=124 OSSD = 210
V = 83 km/h K=124 OSSD
V = 100 km/h K=211 OSSD = 300
CHANGE IN GRADE (%)
LENGTH OF VERTICAL CURVE (m)
0
100
200
300
400
500
600
700
800
900
1
2
3
4
5
6
7
8
9
10
11
12
13
14