Cover Type B

UTS

University of Technology, Sydney

TO BE RETURNED AT THE END OF THE EXAMINATION.
THIS PAPER MUST NOT BE REMOVED FROM THE EXAM CENTRE.

SURNAME: _____

FIRST NAME: _____

STUDENT NUMBER: _____

COURSE: _____

SPRING SEMESTER, 2007

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: TUESDAY 20 NOVEMBER 2006

TIME ALLOWED: TWO Hours plus TEN Mins reading time

START/END TIME: 2:00 pm - 4:10 pm

NOTES/INSTRUCTIONS TO CANDIDATES:

Attempt ALL questions.
Write the answers in the spaces provided.
The questions are NOT of equal value. Marks for each part are shown adjacent to that part of a question.
THIS IS A CLOSED BOOK EXAM.
Calculators and drawing instruments are allowed.
Formulae are provided at the end of the examination paper.
If not enough room for working has been provided, please use the back of adjacent pages and indicate this to the marker.

0 of 10 pages

QUESTION 1 (16 Marks)

A closed traverse was run from A via points B, C, and D, as indicated on the traverse close form below.

From point A, a radiation was made to point X the corner of a house.

(The traverse is shown in a diagram on the next page.)

Compute the traverse misclose and the proportional accuracy of the traverse. **(4 Marks)**

Without making any adjustments, calculate the coordinates of each traverse point. **(4 Marks)**

Calculate the coordinates of point X. **(2 Marks)**

Calculate the bearing and distance of the line XB. **(3 Marks)**

Calculate the perpendicular distance of the corner of the house (X) from the line (DA). **(3 Marks)**

LINE	Adjusted Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							400.000	500.000	A
A-B	106° 22' 30"	70.150							B
B-C	181° 51' 00"'	151.350							C
C-D	270° 33' 30"	82.545							D
D-A	6° 44' 00"	171.440							A
							400.000	500.000	A
A-X	176° 17' 00"	78.935							X

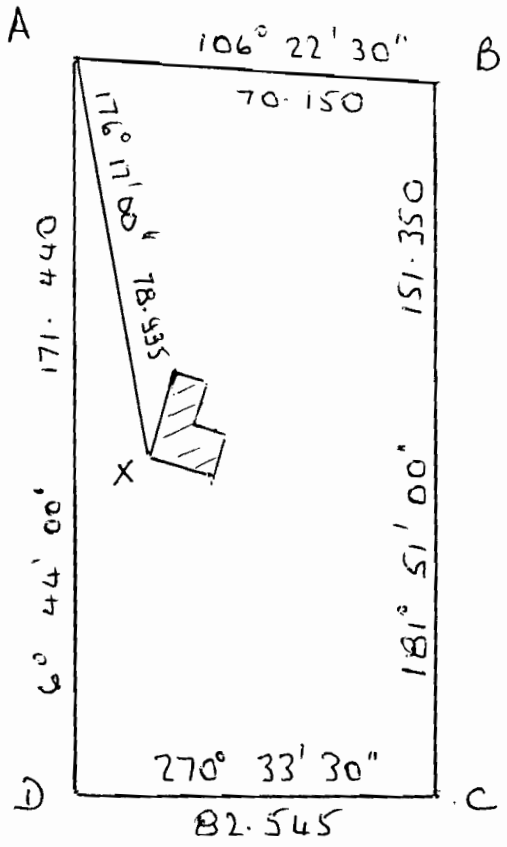
Traverse Linear Misclose ..... Proportional Accuracy .....

Show coordinates of B, C, D and X in the traverse table.

Bearing and distance of line X B .....

Perpendicular distance of X from the line DA .....

P.T.O.


A
106° 22' 30"
B
70.150
176° 17' 00"
78.535
171.440
151.350
X
6° 44' 00"
181° 51' 00"
270° 33' 30"
D
C
82.545


N
Not to Scale

P.T.O.

QUESTION 2 (16 Marks)

A student had commenced horizontal curve set out calculations and had got results as shown in the table below.

What radius had the student been using to calculate those answers? **(4 Marks)**

On checking the work with other members in the group, the student then realised that the calculations were wrong because the wrong radius had been used.

The correct radius that should have been used was 25.0m and the correct tangent distance is 12.738m. Using a radius of 25.0 m calculate the following information and enter the data in the appropriate section of the form below,

- arc length and the chainage of the second TP; **(6 Marks)**
- the total deflection angle and the long chord to set out chainage 160 from TP_1; **(4 Marks)**
- the short chord from TP_2 to the mark at chainage 165 so that the set out can be checked for accuracy. **(2 Marks)**

NB Do not fill in the entire table – just the boxes lightly shaded and edged.

	Chainage	Arc	Defl. Angle	Total Def.	Short Chord	Long Chord
TP_1	146.100			0° 00' 00"		
		3.900	3° 59' 25"		3.896	
	150.000					
		5.000	5° 06' 57"		4.993	
	155.000					
		5.000				
	160.000					
		5.000				
	165.000					
TP_2						

Originally used Radius .....

Arc length using new radius .....

P.T.O.

QUESTION 3 (18 Marks)

On a proposed road longsection, a falling grade of 2.4% meets a rising grade of 4.6% at chainage 660.0 and R.L. 44.32.

The low point **must** be located exactly at chainage 638.0

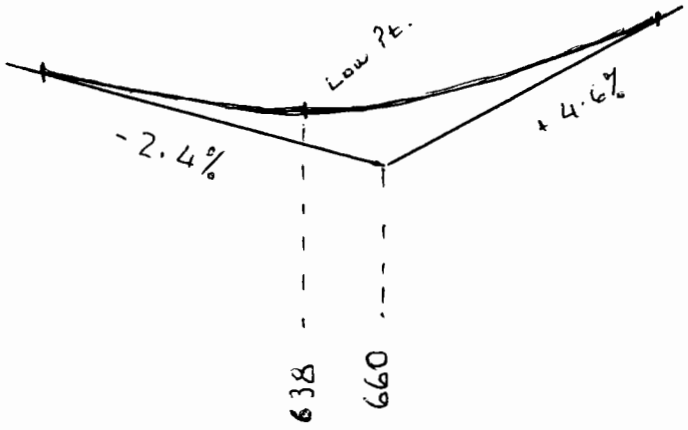
Calculate the length to the vertical curve to exactly meet this requirement. **(8 Marks)**

N.B. If you can not find the length of the curve, assume L = 150m and continue.

Calculate the chainages and R.L.s of the Tangent Points. **(4 Marks)**

Calculate the Design Levels of the proposed road at chainages 610 and 690. **(6 Marks)**

Chainage	Grade	Grade Level	x	Ordinate	Design Level
T.P.1					
610					
I.P. 660.0		44.32			
690					
T.P. 2					



ANSWER

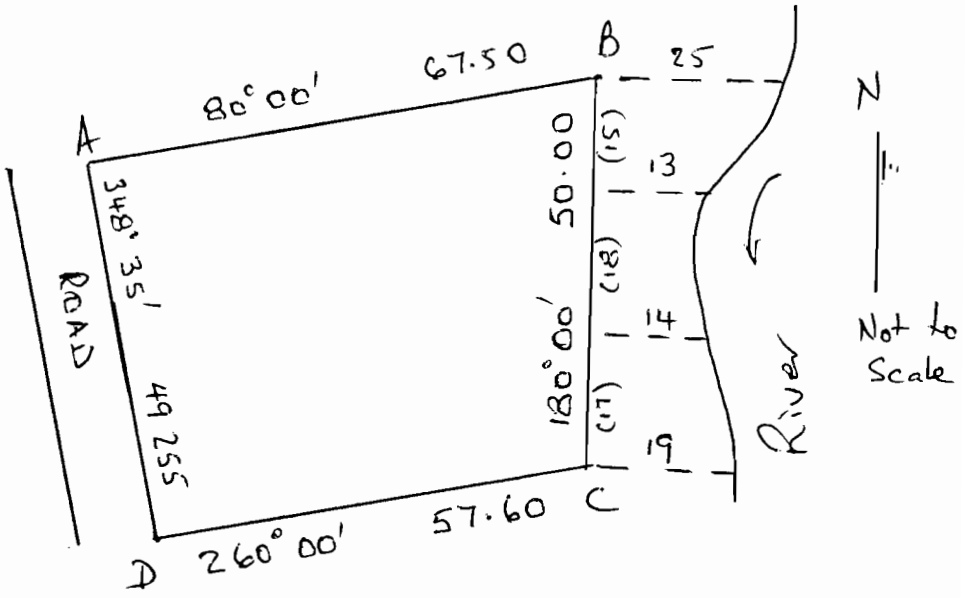
Exact length of VC needed .....

P.T.O.

QUESTION 4 (10 Marks)

It is necessary to find the area of the block of land sketched below. The block is bounded by straight lines on the northern, western and southern sides and by the river on the east. A traverse line was run approximating the river boundary and offsets read from that to the bank as shown.

Calculate the area of the block. by calculating the area within the straight lines (ABCD) and then the offset area. Use the trapezoidal rule for calculating the offset area.



ANSWERS

Area within Straight lines (ABCD) .....

Offset area .....

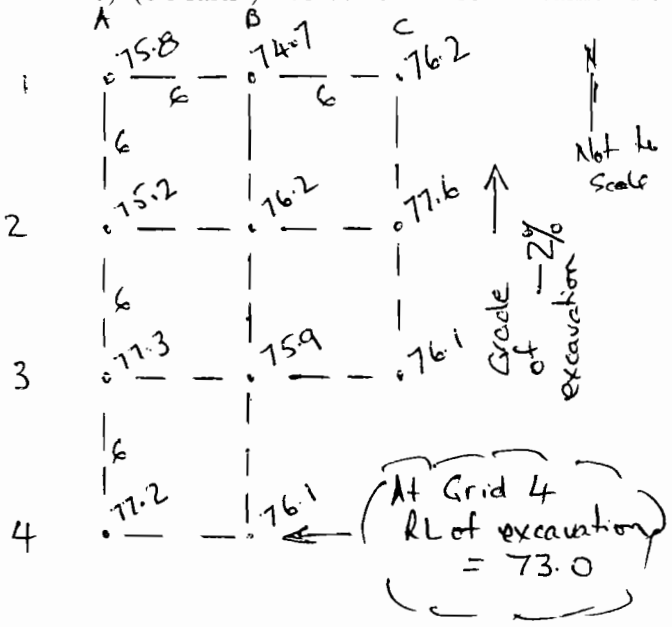
Total Area for the block . .....

P.T.O.

QUESTION 5 (12 Marks)

The grid below was levelled for a proposed basement excavation, which is to have vertical sides around the perimeter. The base of the excavation is to have a 2% grade falling to the north, with the finished (excavated) R.L. at Grid Line 4 being 73.0. Each grid square is 6.0m by 6.0m.

a) (3 Marks) Calculate the finished (excavation) level at each of the grid lines 3, 2 and 1.
b) (3 Marks) Show on the diagram the depth of excavation at each grid point.
c) (6 Marks) Calculate the total volume of excavation required on this site.



ANSWERS

a) Excavation R.L. Grid Line 3 ..... Excavation R.L. Grid Line 2 .....

Excavation R.L. Grid Line 1 .....

c) Total volume to be excavated .....

P.T.O.

QUESTION 6 (12 Marks)

Observations were made to points A and B as follows:

R.L. of Theodolite station 53.25 Height of Instrument 1.75m

Slope Distance	Prism Ht.	Observed Vertical Circle	Horizontal Circle	Vertical Component (V)	HORIZ DIST.	R.L.	Remarks
53.24	1.17	92° 43'	112° 30'				A
85.62	1.17	82° 15'	202° 30'				B

Reduce the observations by completing the table above. **(8 Marks)**

Calculate the grade between A and B. **(4 Marks)**

Formulae:

Horizontal Distance = Slope distance x cos β

V = Slope Distance x sin β and $R.L._x = R.L._T + H.I. + V - \text{Prism Height}$

Grade between A and B .....

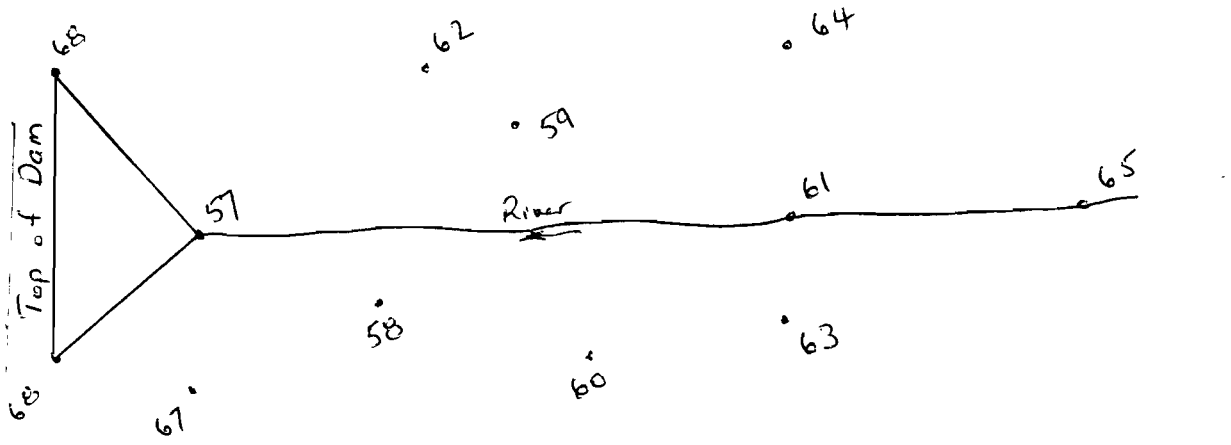
P.T.O.

QUESTION 7 (16 Marks)

a) **(4 Marks)**

An earth fill dam is to be built in a river valley. The face of the dam is to be of constant slope from a base level of R.L. 57 to a top level of R.L. 68 as sketched.
A few other spot levels are shown in the area. The river is of constant slope between the points labelled.

Sketch in on the diagram, contours at a 5m contour interval on this site. LABEL EACH CONTOUR CLEARLY. Do not interpolate – just ensure that the contours you draw go above, below or through the appropriate spot heights.



b) **(4 Marks)**

Identify four (4) items from the list below which are **NOT** included in an Identification Survey Report. Circle the numbers to identify your choices.

1 – The land described in the title exists

2 – The height of the land above sea level.

3 – The existence of any building on the land

4 – The dimensions of the block of land

5 – The number of trees on the land

6 – The positions of any buildings relative to the property boundaries

7 – The positions of any services such sewers, water and electricity lines within the property

8 - Any easements affecting the land

9 – Any encroachments by neighbouring buildings

10 - Whether any of the neighbouring buildings affect the views from the subject property.

P.T.O.

c) **(4 Marks)**
Describe two (2) situations where the use of reflectorless Electromagnetic Distance Measuring units (EDMs) would be preferred over the models which require a prism to be used to reflect the signal.

d) (4 Marks) Briefly explain how Surveyors use GPS readings to get very accurate coordinates (centimetre precision) for control surveys when the GPS readings, by themselves have numerous errors and may only give readings to the nearest metre.

$C_{slope} = -L \times \left(1 - \cos\beta\right)$

$C_{slope} = -\left[\frac{\Delta h^2}{2L_m} + \frac{\Delta h^4}{8L_m^3}\right]$

$C_{temp} = \pm L \times \alpha \times (\Delta t)$

$\alpha_{steel} = 11.2 \times 10^{-6}/^0C$

$C_{sag} = -\frac{w^2 \times L^3}{24 \times T^2} \times \cos\beta$

$Grade = \frac{\Delta h}{HorDist.} \times 100$

$OM = \frac{L \times \left(G_2 - G_1\right)}{800}$

$PQ = \frac{4 \times x^2 \times OM}{L^2}$

$PQ = \left(\frac{G_2 - G_1}{200L}\right) \times x^2$

$x = \left(\frac{G_1}{G_1 - G_2}\right) \times L$

$H = 100 \times s \times \cos^2\theta$

$V = 100 \times s \times \sin\theta \times \cos\theta$

$RL_S = RL_T + HI + V - m$

$Tangent\ Dist. = R\tan\frac{\Delta}{2}$

$Secant\ Dist. = R\sec\frac{\Delta}{2}$

$External\ Dist. = R\left(\sec\frac{\Delta}{2} - 1\right)$

$Mid\ Ord = R\left(1 - \cos\frac{\Delta}{2}\right)$

$Chord = 2R\sin\frac{\Delta}{2}$

$Arc = R\theta^{rad.}$

$Arc = R\theta^{deg} \times \frac{\pi}{180}$

$\delta = \frac{arc}{2R} \times \frac{180}{\pi}$

$Chord = 2R\sin\delta$

$y_0 = R - \sqrt{R^2 - \left(\frac{C}{2}\right)^2}$

$y_1 = y_0 - \left[R - \sqrt{R^2 - x^2}\right]$

$Area = \pi R^2$

$Sector = \frac{1}{2}R^2\theta$

$Segment = \frac{1}{2}R^2\left(\theta - \sin\theta\right)$

$2 \times Area = (N_1E_2 + N_2E_3 + \cdots N_NE_1) - (E_1N_2 + E_2N_3 + \cdots E_NN_1)$

$Volume = \frac{w}{2}\left(A_1 + 2A_2 + 2A_3 + \ldots.2A_{n-1} + A_n\right)$

$Volume = \frac{Area}{4}\left(\Sigma d_1 + \Sigma 2d_2 + \Sigma 3d_3 + \Sigma 4d_4\right)$

$Area = w\left(\frac{O_1 + O_2}{2}\right)$