Cover Type B

U|T|S

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, 2006

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: MONDAY 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.

QUESTION 1 (16 Marks)

In a Surveying practical exercise students conducted a triangular closed traverse as shown in the traverse close table below.

a) (8 Marks) Calculate the linear misclose of the traverse. You do not need to calculate any coordinates
b) (5 Marks) It is suspected that an error of exactly 1m was made when recording one of the distances. Nominate the line most likely to be in error and what the correct distance should be.
c) (3 Marks) Assume that after the correction is made, the linear misclose is reduced by exactly 1.00m, calculate the proportional accuracy of the traverse.

LINE	Adjusted Bearing	Horizontal Distance	Δ E		Δ N	
			E (+)	W (-)	N (+)	S(-)
A-B	63° 15' 40"	48.810				
B-C	202° 55'00"	45.545				
C-A	307° 47'20"	33.660				

ANSWERS

Linear Misclose .....

Line most likely in error ..... Correct Distance .....

Proportional Accuracy of traverse, after the assumed correction of the distance error

.....

P.T.O.

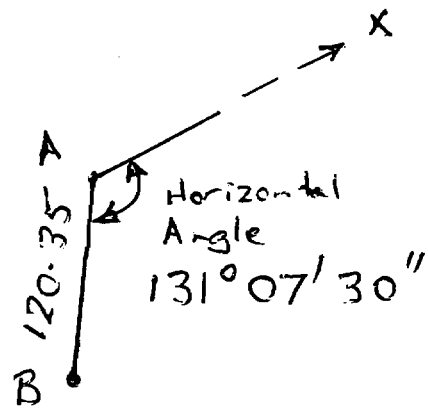
QUESTION 2 (14 Marks)

A theodolite was set up on point A and sighted to point X as azimuth with a horizontal circle reading set at 0° 00' 00".

A horizontal circle reading was then made by the theodolite to a point B, found to be exactly a horizontal distance of 120.35m away.

Coordinates of Station A: 465.780 m E, 2243.690 m N

Coordinates of Station X: 639.966 m E, 2423.019 m N



Calculate:

a) **(4 Marks)** The bearing from A to X.

b) **(6 Marks)** The coordinates of B

c) **(4 Marks)** The bearing and distance from B to X.

LINE	Adjusted Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	

ANSWERS

a) Bearing from A to X .....

b) Coordinates of B ....., ...

c) Bearing and Distance B to X .....

P.T.O.

QUESTION 3 (20 Marks)

On a proposed road, a rising grade of 2.3% meets a falling grade of 1.7%.

At chainage 880.0, which 70.0m before the second tangent point, the grade level is 97.79 and the design level (i.e on the vertical curve) is 97.545.

Calculate the exact length of the vertical curve needed to pass through that R.L.
Calculate the chainages of T.P.1, I.P and T.P.2 for the curve and note them on the table below.
Calculate the R.Ls for the Design Level of the road at 200m intervals of running chainage throughout the curve. Place your answers in the table below.

N.B. If you can not find the length of the curve, assume L = 500m and continue.

Chainage	Grade	Grade Level	x	Ordinate	Design Level
T.P.1					
I.P.					
880		**97.79**			**97.545**
T.P. 2					

ANSWER
Exact length of VC needed .....

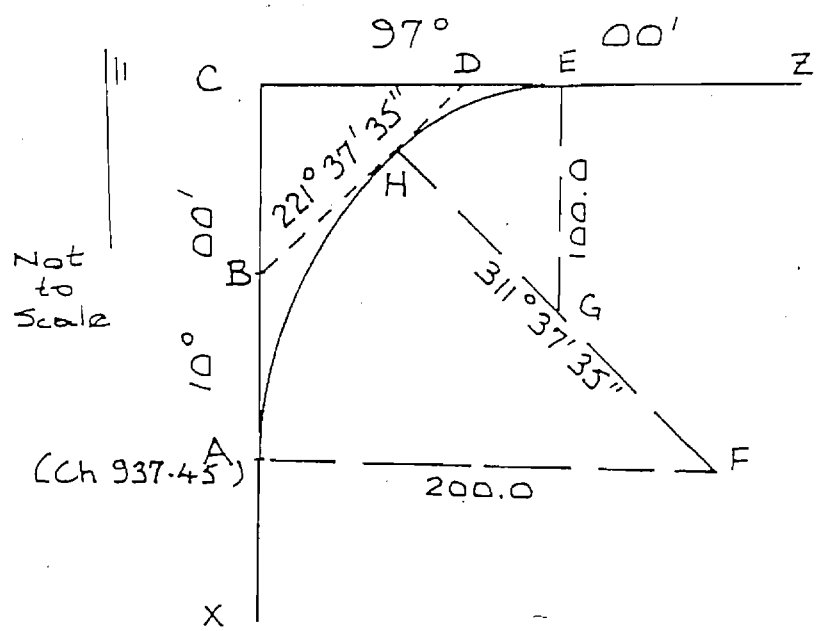
P.T.O.

QUESTION 4 (16 Marks)

A mine railway track XA at a bearing of 10° is joined to a branch track EZ which is at a bearing of 97° by a compound circular curve. (A compound circular curve comprises two circular curves with a common tangent point.) The radii of the two curves are 200.00m and 100.00m as shown in the diagram below.

Points A and E are the tangent points on the straights. The bearing of the line between the two centres F and G is 311° 37' 35". The chainage of A is 937.450 and the chainage increases towards E.

a) (6 Marks) Calculate the total arc length AHE.
b) (4 Marks) Calculate the length BD.
c) (6 Marks) Calculate the deflection angles and chords to set out the points listed in the table below, from the tangent point A.



ANSWERS

Total Arc Length AHE .....

Length BD .....

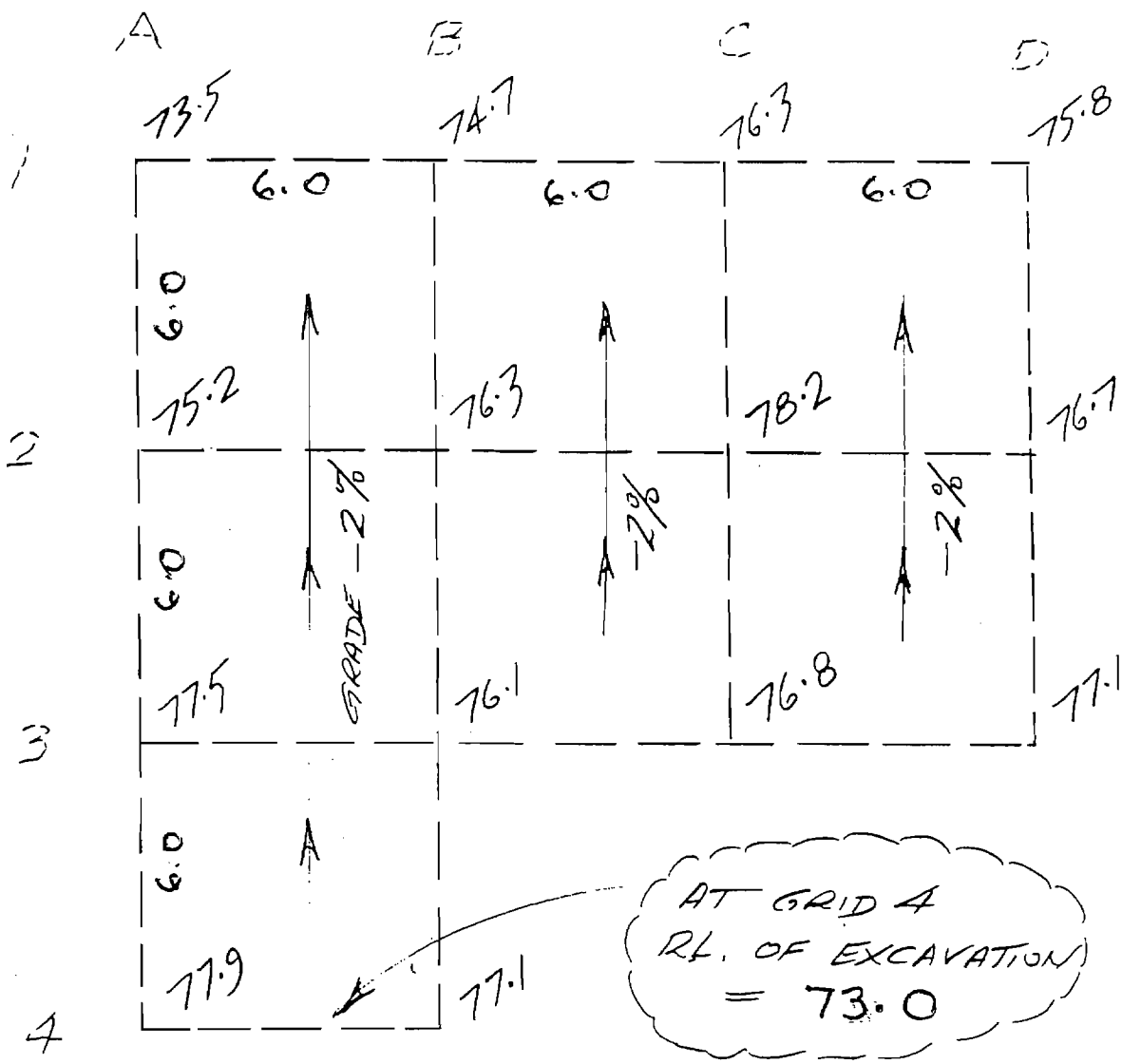
Point to be pegged	Arc Length	δ_i	δ_T	Chord
T.P. 'A' 937.450				
950.0				
975.0				

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 .....

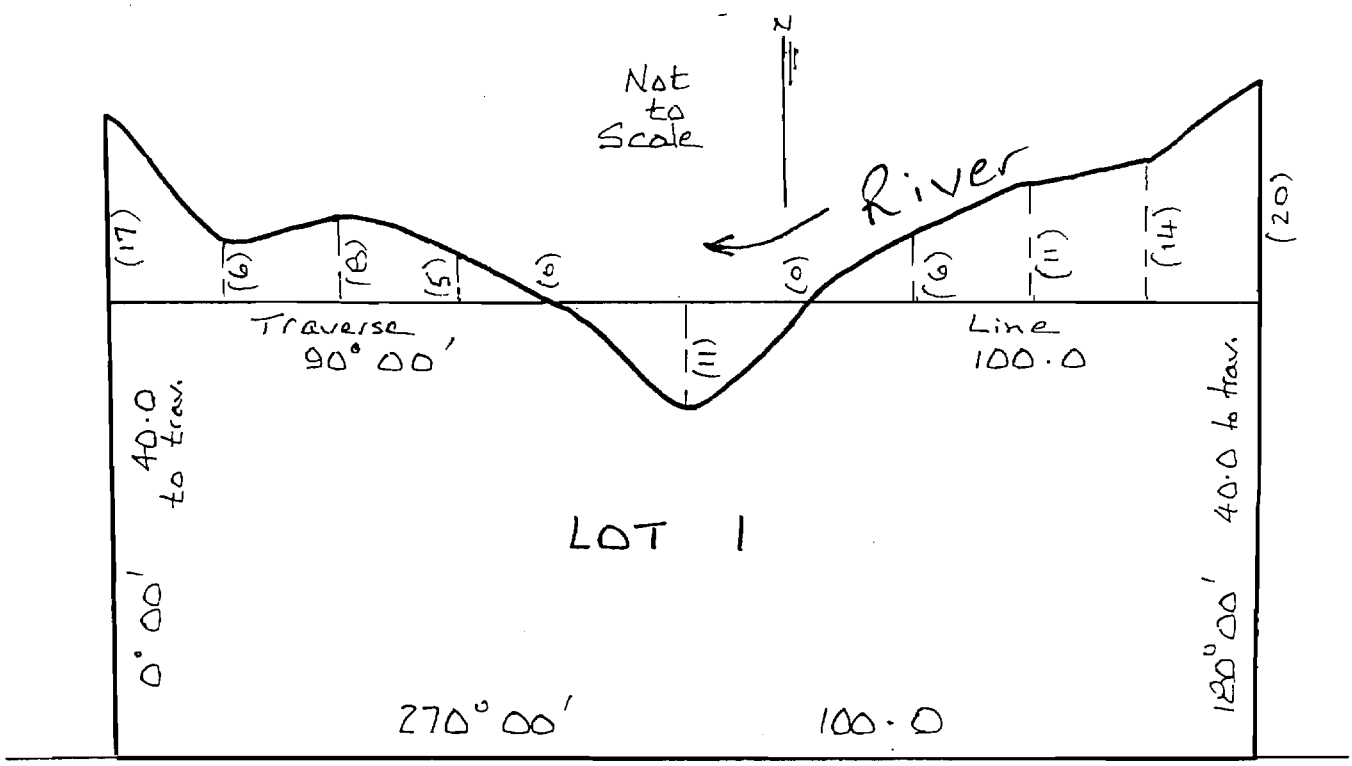
c) Total volume to be excavated .....

P.T.O.

QUESTION 6 (12 Marks)

It is necessary to find the area of Lot 1 on the plan below. Lot 1 is bounded by straight lines on the eastern, southern and western sides and by the river on the north. A traverse line was run approximating the river boundary and offsets read from that to the bank. Each offset was taken at exactly 10m intervals along the traverse line.

Calculate the area of Lot 1, by calculating the area within the straight lines and then the offset area. Use the trapezoidal rule for calculating the offset area.



ANSWERS

Area within Straight lines .....

Offset area .....

Total Area for Lot 1. .....

P.T.O.

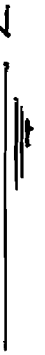
QUESTION 7 (10 Marks)

a) **(3 Marks)**

Sketch, and LABEL, in the space below, the top FOUR (4) contour lines of an imaginary hill which has the following features:

The hill is roughly rectangular in shape; the R.L. at the very top of the hill is 105m; the Contour Interval is to be 10m.

On the western side of the hill, the ground fall steeply; on the eastern side the slope is very gentle and a creek runs from the top of the hill to the south.



b) (2 Marks) Who are the only people allowed, by law, to undertake cadastral surveys and what are Cadastral Surveys?

c) **(2 Marks)**
List two (2) advantages that the modern Electromagnetic Distance Measuring units (EDMs) have over traditional Surveying techniques for measuring distances.

d) (3 Marks)
Most modern surveying equipment, including levels now have automatic recording of observations which can be then loaded directly to a computer for calculations. With such automatic recording there is no need to field surveyors to keep accurate sketches and paper records of their field work.
Discuss this statement.

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

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

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

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

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

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

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

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

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

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

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

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

$RL_S = RL_T + HI + V - m$

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

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

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

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

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

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

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

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

$Chord = 2R\sin\delta$

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

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

$Area = \pi R^2$

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

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

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

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

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

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