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, 2000

SUBJECT NAME :SURVEYING

SUBJECT NO. :48320

DAY/DATE :WEDNESDAY 29 NOVEMBER 2000

TIME ALLOWED : TWO Hours plus TEN Min. reading time

START/END TIME : 9:30 am - 11:40 am

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 (20 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. **(5 Marks)**
Without making any adjustments, calculate the coordinates of each traverse point. **(6 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). **(4 Marks)**

LINE	Adjusted Bearing	Horiz. Dist	Δ E		Δ N		CO-ORDINATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							400.000	500.000	A
A-B	95° 22' 30"	70.150							B
B-C	170° 51' 00"	151.350							C
C-D	259° 33' 30"	82.545							D
D-A	355° 44' 00"	171.440							A
							400.000	500.000	A
A-X	165° 17' 00"	78.935							X

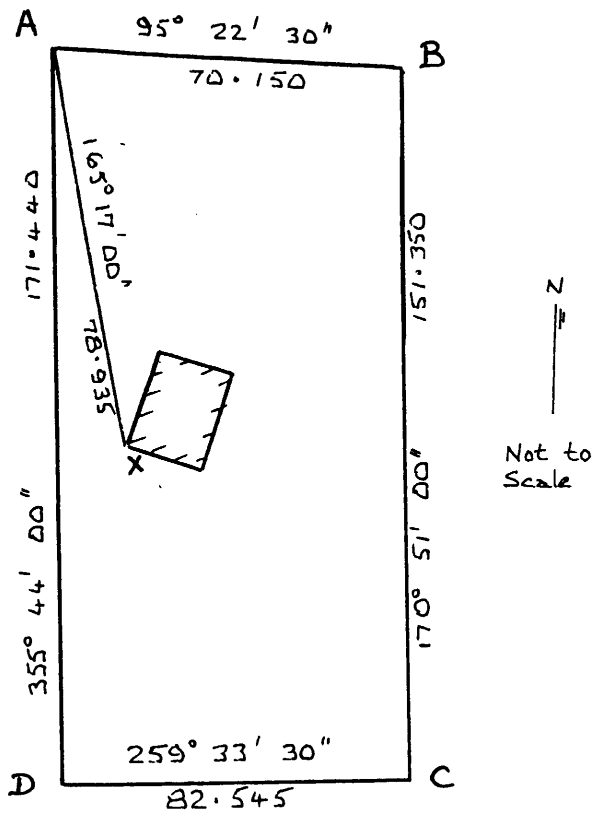
Traverse Linear Misclose .... **Proportional Accuracy ....**
Show coordinates of B, C, D and X in the traverse table.

Bearing and distance of line X B ....

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

P.T.O.

WORKING SPACE FOR QUESTION 1
(Please write your answers in the spaces provided on the previous page.)



P.T.O.

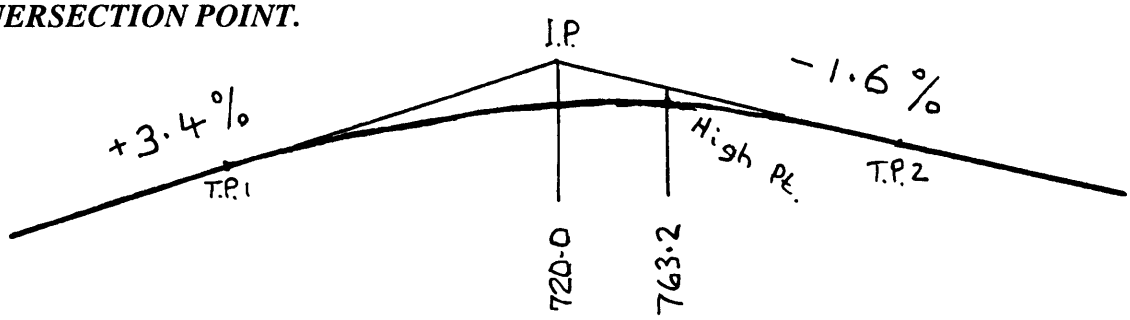
QUESTION 2 (20 Marks)

A rising grade of 3.4% meets a falling grade of 1.6% at an Intersection Point, whose chainage is 720.0m and which has an R.L. of 75.45.

The highest point on the curve **must** be located at chainage 763.2m.

Calculate the length of the vertical curve to **exactly** meet this specification.
Calculate the chainages of the two Tangent Points and enter them into the table below.
Calculate the design surface levels for each tangent point and all the other chainages listed in the table below.

IF YOU CAN NOT FIND THE LENGTH OF THE VERTICAL CURVE, ASSUME IT IS 250m AND CONTINUE WITH THE QUESTION ADOPTING THE DATA FOR THE INERSECTION POINT.



CHAINAGE		GRADE	GRADE LEVEL	ORDINATE	DESIGN R.L.
T.P.1					
	640.0				
	690.0				
I.P.	720.0				
	750.0				
	763.2				
	800.0				
T.P.2					

ANSWERS

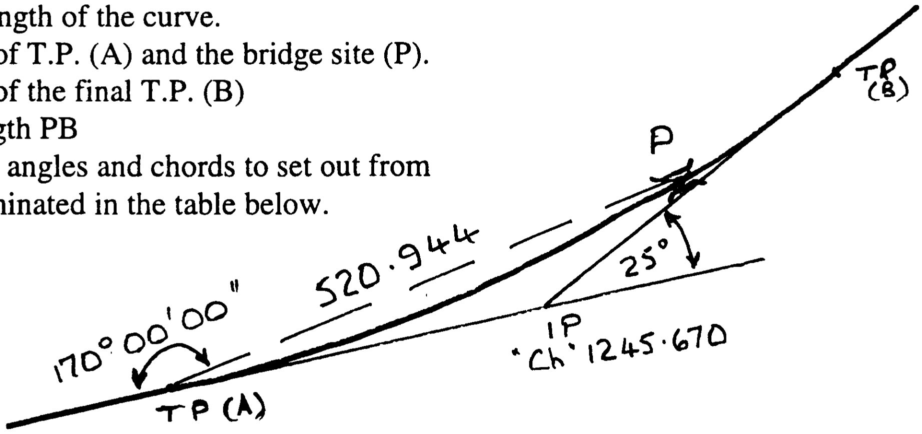
a) (8 Marks) Precise Length of Vertical Curve ....

b) (12 Marks) Design Levels ---- see table

QUESTION 3 (20 Marks)

To meet a bridge site it is essential for a horizontal curve to pass though point P, as shown below. The total deflection angle for the curve is 25° and the "chainage of the I.P. is 1245.670m. A theodolite was set up at the tangent point A, and an angle and distance were read to P, relative to the straight approaching the TP.

Calculate the radius of the horizontal curve needed to exactly go through the point P.
Calculate the tangent length of the curve.
Calculate the chainage of T.P. (A) and the bridge site (P).
Calculate the chainage of the final T.P. (B)
Calculate the chord length PB
Calculate the deflection angles and chords to set out from T.P. (A), the points nominated in the table below.



Point to be pegged	Arc Length	δ_I	δ_T	Chord
(T.P. $_1$)				
1000.000				
1250.000				
(T.P. $_2$)				

IF YOU CAN NOT FIND THE RADIUS OF THE HORIZONTAL CURVE, ASSUME IT IS 1400m AND CONTINUE WITH THE QUESTION.

a) Radius of the horizontal curve **(4 Marks)** ....

b) Tangent length of the curve. **(2 Marks)**.........................

c) Chainage of T.P. (A) **(2)** .... Chainage of the bridge site (P) **(2)**..............

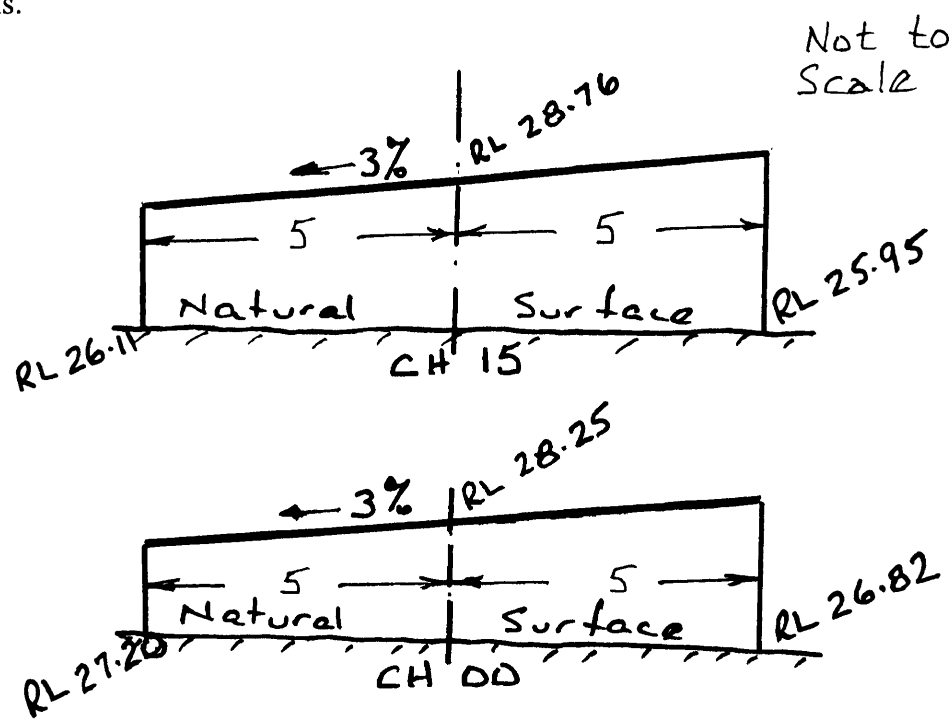
d) Chainage of the final T.P. (B) **(3 Marks)** ....

e) Chord length PB. **(3 Marks)** ....

f) Show the deflection angles and chords in the table above **(4 Marks)**

QUESTION 4 (8 Marks)
The cross sections for a proposed driveway are shown below. Use the end area method to calculate the volume of material needed for the driveway.

Assume the sides are vertical and make no allowance for compaction. It is strongly recommended that you show the results of each stage of your calculations on the diagram in the appropriate locations.



Area of Cross section at Chainage 00 ....

Area of Cross section at Chainage 15 ....

VOLUME NEEDED ....

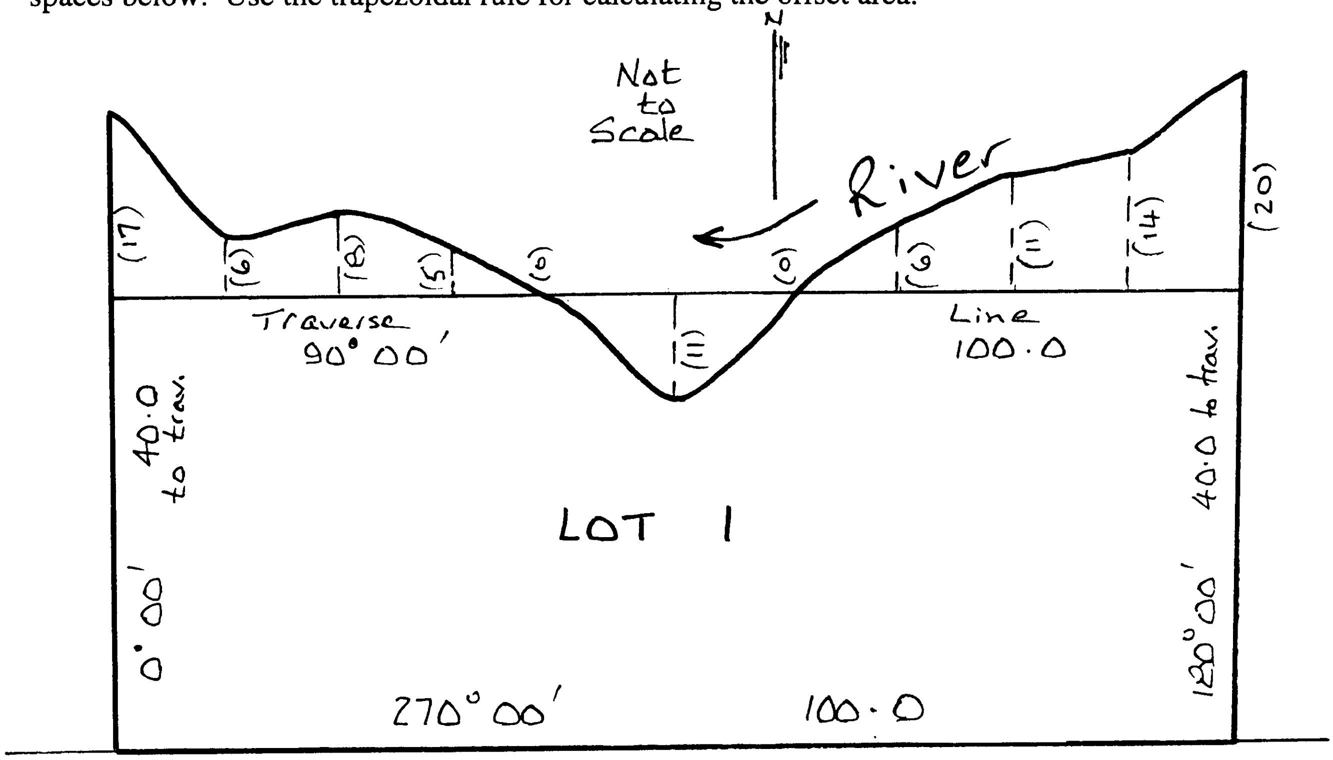
P.T.O.

QUESTION 5 (6 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.

Please note that you should show answers to each of the two stages in the calculations in the spaces below. Use the trapezoidal rule for calculating the offset area.



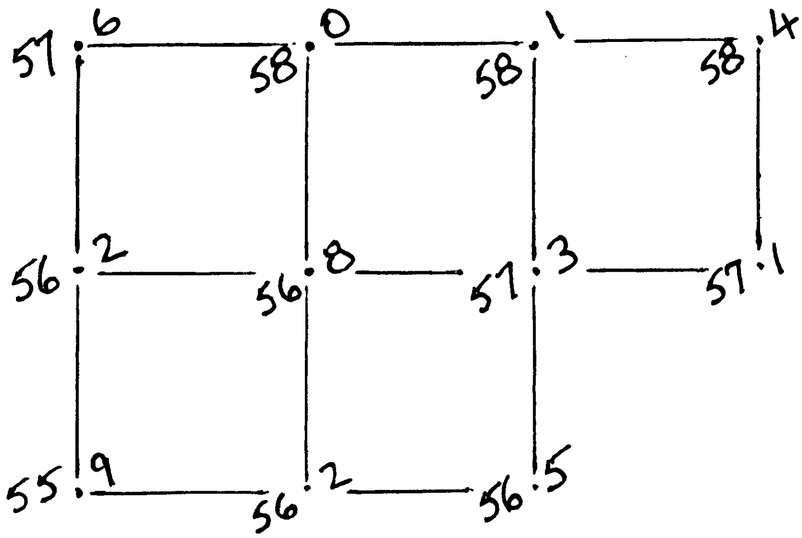
Area within Traverse ....

Offset Area ....

Total Area ....

P.T.O.

QUESTION 6 (8 Marks)
Calculate the volume of material to be excavated from the building site in the diagram below. The excavation is to be made to R.L. 55.5m. Points have been set out at 5m grid intervals. Assume that the sides are vertical.



Volume to be removed. ....

P.T.O.

QUESTION 7 (18 Marks)

For each question, please write a brief answer in the space provided.

a) (4 Marks)

Modern Surveying equipment, such as a Total Station, was used during the Sydney Olympic Games to determine results in field events such as the Long Jump, Triple Jump, Discus and Javelin.

Select one such event and describe how the Total Station was used to rapidly display the results.

b) (3 Marks)

One of the latest developments in Total Stations is the instrument's ability to measure distances in "reflectorless" mode. Briefly describe what this means and explain one advantage to a Surveyor of being able to work in this mode.

c) (4 Marks)
Explain what is meant by the term "Motorised Total Station". Give an example of an Engineering Surveying situation where a Motorised Total Station would be of benefit to the Surveyor and briefly explain why that benefit occurs from its use.

d) (4 Marks)
Surveyors developed a system when using the Global Positioning System to overcome the errors that had previously been introduced by the U.S. Department of Defence. While these errors are now no longer present, the method is still in use for accurate Surveying. Briefly describe, the principles of this method,

P.T.O.

f) (3 Marks)

In using a computer program such a Landmark to prepare a contour plan, the program will create triangles between Surveyed points. The operator is then required to adjust the triangles. Explain why the triangles need to be adjusted and the principles that should guide an operator in making these adjustments.

P.T.O.

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

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

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

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

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

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

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

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

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

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

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

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

$RL_S = RL_T + HI + V - m$

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

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

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

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

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

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

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

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

$Chord = 2R \sin \delta$

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

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

$Area = \pi R^2$

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

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

$2 \times Area = (N_1 E_2 + N_2 E_3 + \cdots N_N E_1) - (E_1 N_2 + E_2 N_3 + \cdots E_N N_1)$

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

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