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, 2004

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: SATURDAY 27 NOVEMBER 2004

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 (20 Marks)

A theodolite was set up on point A and sighted to point X as azimuth.
A stadia reading was then made to a staff held on point B, approximately 50m away and observations as shown in the booking sheet and field sketch below were made.

Coordinates of Station A: 1065.780 m E, 2543.690 m N
Coordinates of Station X: 1239.966 m E, 2723.019 m N

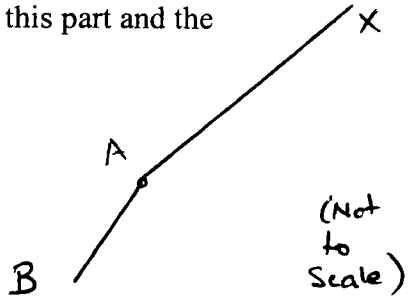
R.L. of point A: 54.455, Height of theodolite at point A: 1.68m

Stadia Readings

Top	Mid	Bot	Vert Circle	V	Hor Circle	Distance	R.L.	Remarks
-	-	-	-		00° 00'	-	-	X
1.515	1.256	1.000	96° 37'		176° 45'			B

Calculate:

a) **(3 Marks)** The bearing from A to X.
b) **(8 Marks)** The distance to B and its R.L.
c) **(6 Marks)** The coordinates of B – { Note; If you can not find the distance A-B in part a), or your answer is not within 2m of 51.0m please use 51.0m for this part and the remainder of the question}
d) **(3 Marks)** The bearing and distance from B to X



ANSWERS

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

b) Distance AB ....., R.L. of B .....

c) Coordinates of B ....., ...

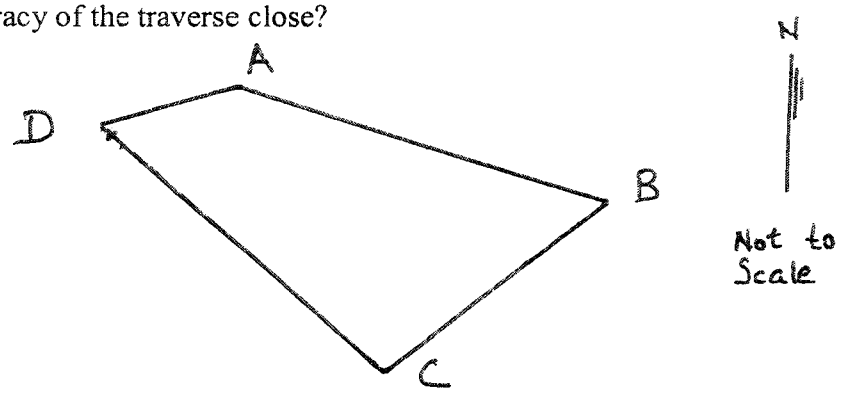
d) Bearing and Distance B to X

P.T.O.

QUESTION 2 (12 Marks)

A closed traverse was run from A via B, C and D and back to A. The adjusted bearings and horizontal distances are shown in the traverse close below.

Calculate the misclose of the traverse. Do not find the coordinates of the points
What is the proportional accuracy of the traverse close?



LINE	Adjusted Bearing	Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
									A
A-B	125° 10' 30"	145.070							B
B-C	228° 35'00"'	101.770							C
C-D	328° 29' 00"	152.450							D
D-A	60° 43' 30"	42.835							A

ANSWERS

Misclose ..... Proportional Accuracy .....

P.T.O.

QUESTION 3 (20 Marks)
A sag vertical curve on a road has to join two grades of – 5.6% and + 2.8%. At chainage 150.00, on the –5.6% grade line, the design (and grade) level of the road is 56.270

To provide clearance under a bridge, the design level of the road at the Intersection Point should be no higher than 52.406. The chainage of the Intersection point is 255.00

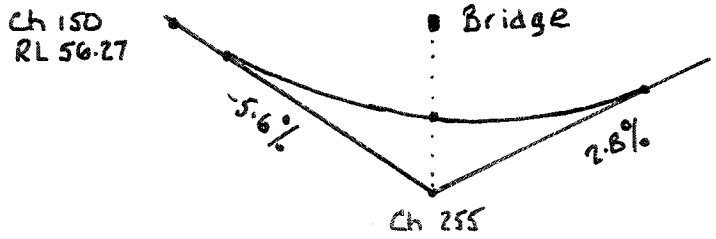
a) (6 Marks) Calculate the Length of Vertical Curve (2 decimal places) that would go exactly though that R.L.
For design simplicity it was decided to adopt 190m for the length of the vertical curve.

b) (10 Marks) Complete the table below, calculating TP chainages, grade levels, ordinates and Design Levels for the nominated Points.

c) (4 Marks) Also calculate the chainage and R.L. of the Low Point of the Curve.

Chainage	Grade	Grade Level	x	Ordinate	Design Level
150		56.27			56.27
TP					
180.0					
(IP) 255.0					
300.0					
TP					

LP					



ANSWER
Exact length of VC needed to pass through R.L. 52.406 at I.P. .....

P.T.O.

QUESTION 4 (20 Marks)

A horizontal curve has to join to straights AB and BC, whose bearings are 120° and 82° respectively, as indicated in the diagram. A and C are tangent points

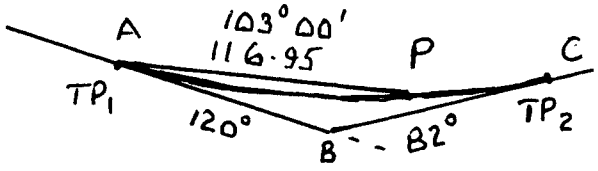
The curve must pass through point P exactly. To locate P, a bearing and a distance was measured from A to P as shown.

a) (6 Marks) Calculate the exact radius for the curve to pass through P. (2 decimal places). If you can not find a radius, please use 210.0m for the remainder of the question.

b) (6 Marks) If the "chainage" of B is 872.3668, calculate the chainages of A and C.

c) (4 Marks) Calculate the chord length from P to C.

d) (4 Marks) Calculate the deflection angle and chord to set a mark at chainage 870.0



ANSWERS

a) Exact Radius to pass through P .....

b) Chainage of A, ...Chainage of C .....

c) Chord PC .....

d) Deflection Angle for 870.0 ..... Chord .....

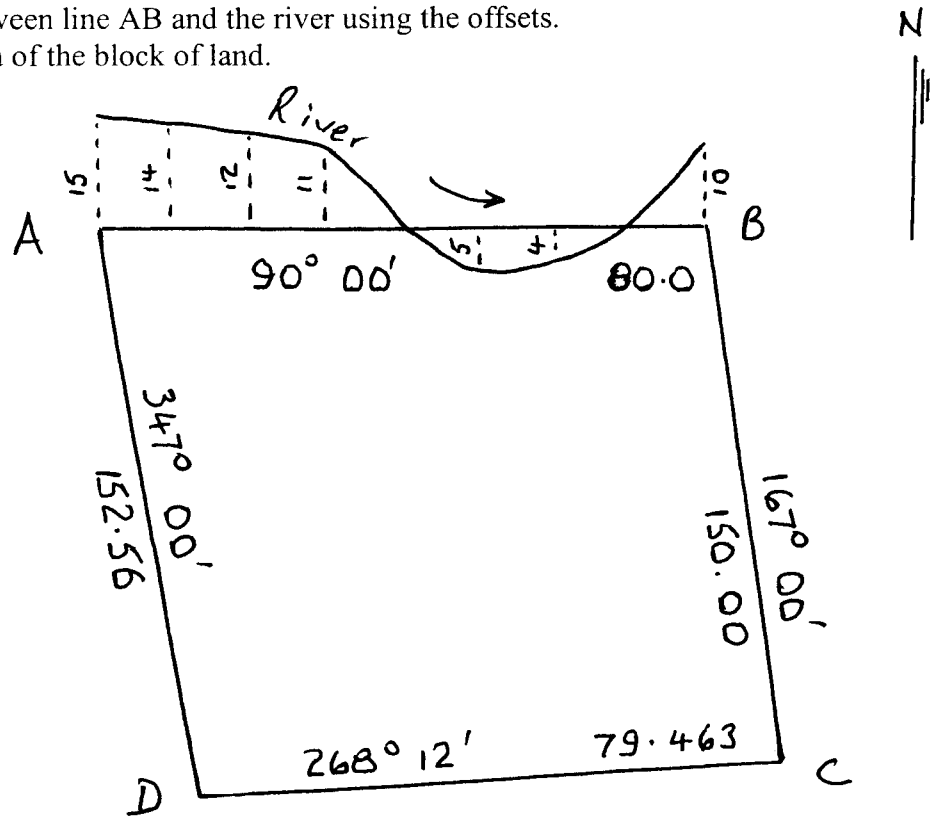
P.T.O.

QUESTION 5 (8 Marks)

A block of land has one boundary as a river frontage with the other three sides BC, CD and DA being straight lines. A surveyor marked the line AB adjacent to the river and measured offsets every 10m along the line, to the river, to allow the area of the block to the calculated.

Calculate:

a) the area within the straight lines ABCD, and
b) the area between line AB and the river using the offsets.
c) the total area of the block of land.



ANSWERS

a) Area inside lines ABCD ..... b) Offset area .....

c) Total area of land .....

P.T.O.

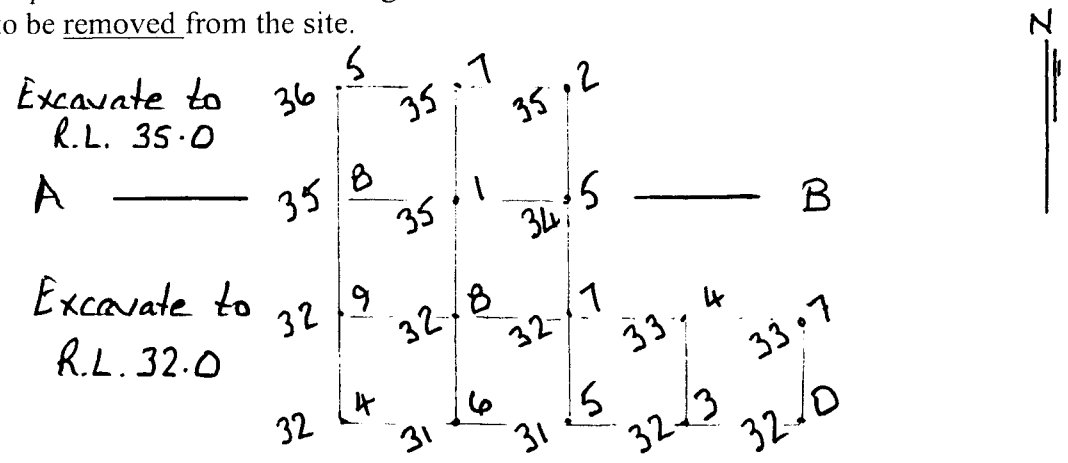
QUESTION 6 (10 Marks)

To estimate the amount of excavation on a building site a grid was set out at 5m intervals, as shown.

To the north of line AB, the excavation is to be to R.L. 35.0 while to the south of line AB the excavation is to be to R.L. 32.0

Assume that any fill needed on the site will be obtained from the excavation.

Use the spot levels shown on the diagram below to calculate the amount of material that needs to be removed from the site.



ANSWER

Volume of material to be removed from site .....

P.T.O.

QUESTION 7 (10 Marks)

a) **(2 Marks)** What is meant by the term "Cadastral Surveys"?

b) (2 Marks) Who are the only people permitted by law, to undertake cadastral surveys?

c) (3 Marks) What is a "motorised total station" and what capability does it have to assist Surveyors or Engineers?

d) (3 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.

P.T.O.

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

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

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

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

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

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

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

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

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

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

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

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

$RL_S = RL_T + HI + V - m$

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

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

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

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

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

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

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

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

$Chord = 2R\sin\delta$

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

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

$Area = \pi R^2$

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

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

$Vol = \frac{w}{3}\left(A_1 + 4\sum \text{even areas} + 2\sum \text{odd areas} + A_n\right)$

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

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