Cover Type B

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, 2008

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: TUESDAY 11 NOVEMBER 2008

TIME ALLOWED: TWO Hours plus TEN Mins reading time

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

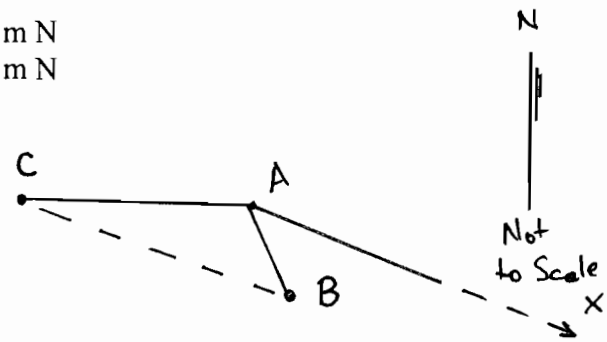
NOTES/INSTRUCTIONS TO CANDIDATES:

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.
NON Programmable Calculators ONLY and drawing instruments are allowed.
Formulae are provided at the end of the examination paper.
All of the diagrams are sketches for illustrative purposes and are not to scale.
If not enough room has been provided for calculations or written answers, please use the back of adjacent pages and note this fact, so the marker can see your complete answer or working.

QUESTION 1 (14 Marks)
A theodolite was set up on point A and sighted to point X as azimuth.

Coordinates of Station A: 2060.320 m E, 2393.450 m N
Coordinates of Station X: 2356.247 m E, 2145.137 m N

This sighting was used as an azimuth for some radiations to electricity poles B and C, as tabulated in the booking sheet below.
Reduce the angles in the table below.



Theodolite set up at A

Target	Face Left	Face Right	Mean	Horiz. Distance
X	0° 00' 00"	180° 00" 00"		
B	35 °30' 00"	215° 32" 00"		27.45
C	173° 25' 00"	353° 29" 00"		58.36

Calculate:
a) **(3 Marks)** The bearing from A to X.
b) **(4 Marks)** The bearings of the radiations from A to each of B and C
c) **(3 Marks)** The Co-ordinates of Points B and C.
d) **(4 Marks)** The bearing and distance from B to C

LINE	Adjusted Bearing	Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							2060.320	2393.450	A
									B
							2060.320	2393.450	A
									C

ANSWERS
a) Bearing from A to X ……..

b) Bearing AB …….., Bearing AC ……

c) Coordinates of B ……, ……..

Coordinates of C……, ……..

d) Bearing and Distance B to C ……..

P.T.O.

QUESTION 2 (12 Marks)

A closed triangular traverse was run by Civil Engineering students at Victoria Park from A via B and C and back to A. The bearings and distances are shown in the traverse close table below.

Calculate the misclose of the traverse. There is no need to find the coordinates of the points

From the size of the misclose, it appears that an error was made in the field work. The angular misclose is of an acceptable standard.

Suggest how the error was made and what size it is.
Also state which line is most likely to be in error.

Correct that line and then calculate

i) the new misclose and,

ii) 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	161° 30' 30"	48.050							B
B-C	36° 16'40"	34.450							C
C-A	296° 32'40"	40.805							A

ANSWERS

Original Traverse Misclose .....

How would the error most likely have been made

What size is the error .....

Which line is most likely to be in error .....

New Misclose .....

Proportional Accuracy of Traverse .....

P.T.O.

QUESTION 3 (20 Marks)
The I.P. of a falling grade of 3.3% and a rising grade of 4.7% lies at Chainage 405.0 and an R.L. of 22.41. A point 'A', at chainage 255.0, has an R.L. of 27.36, lies on the existing road and must not be altered when a new Vertical Curve is designed.

The new vertical curve should pass exactly through an R.L. of 23.71 at a chainage 150m on from Point 'A'.

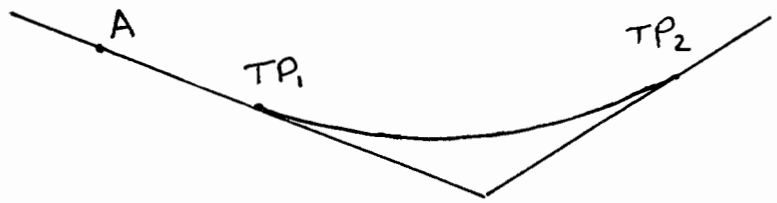
a) (6 Marks) Calculate the length of vertical curve needed to exactly meet this criterion. For design simplicity it was rounded off to the nearest metre for further calculations. If you can not find the length needed, adopt L = 150m and continue with the calculations.

b) (10 Marks) Complete the table below, calculating and showing the 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
'A' 255.0		27.36			27.36
TP					
370.0					
(IP) 405.0		22.41			
420					
TP					

LP					



ANSWER
Exact length of VC needed .....

P.T.O.

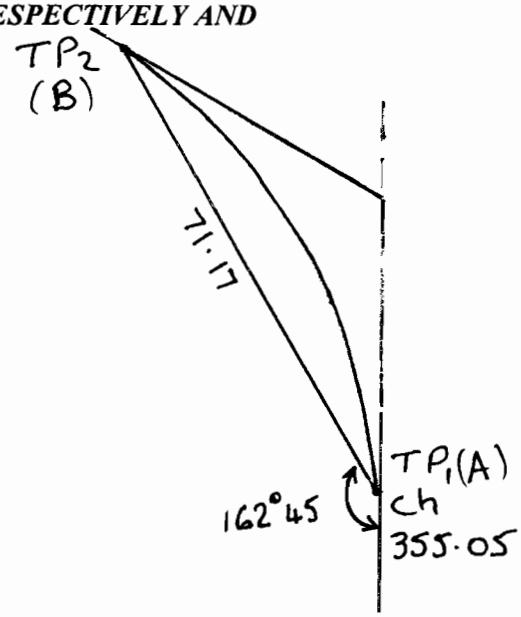
QUESTION 4 (20 Marks)

A horizontal (circular) curve is to be built. A theodolite was set up on point 'A' which is a tangent point and a horizontal angle and a distance were read to the second tangent point 'B', as shown. The chainage of 'A' is 355.05.

Calculate:

a) (2 Marks) The total deflection angle
b) (6 Marks) The radius of the curve
c) (2 Marks) The distance from T.P.'B' to I.P.
d) (2 Marks) The chainage of T.P. 'B'
e) (6 Marks) The deflection angles and long chords that would be needed to set out points at chainages 375 and 400, from T.P. 'A'.
f) (2 Marks) The length of the short chord between 375 and 400 so that the set out could be checked.

IF YOU CAN NOT FIND THE DEFLECTION ANGLE OR THE RADIUS OF THE HORIZONTAL CURVE, ASSUME THEY ARE 30° and 150m RESPECTIVELY AND CONTINUE WITH THE QUESTION.



Point to be pegged	Arc Length	δ_i	δ_T	Chord
T.P. 'A' 355.050				
375				
400				

ANSWERS

a) Total Deflection Angle for the curve .....

b) Exact radius required .....

c) The distance from T.P.'B' to I.P. .....

d) Chainage of T.P.'B' .....

e) Please show Deflection Angles and Long Chords in the table above.

f) Short Chord between marks placed at 375 and 400 .....

P.T.O.

QUESTION 5 (12 Marks)

A block of land in the sketch plan below is bounded by straight lines connecting points A, B, C and D, and then the river bank as shown by the thick line.

The area of the block of land has to be found.

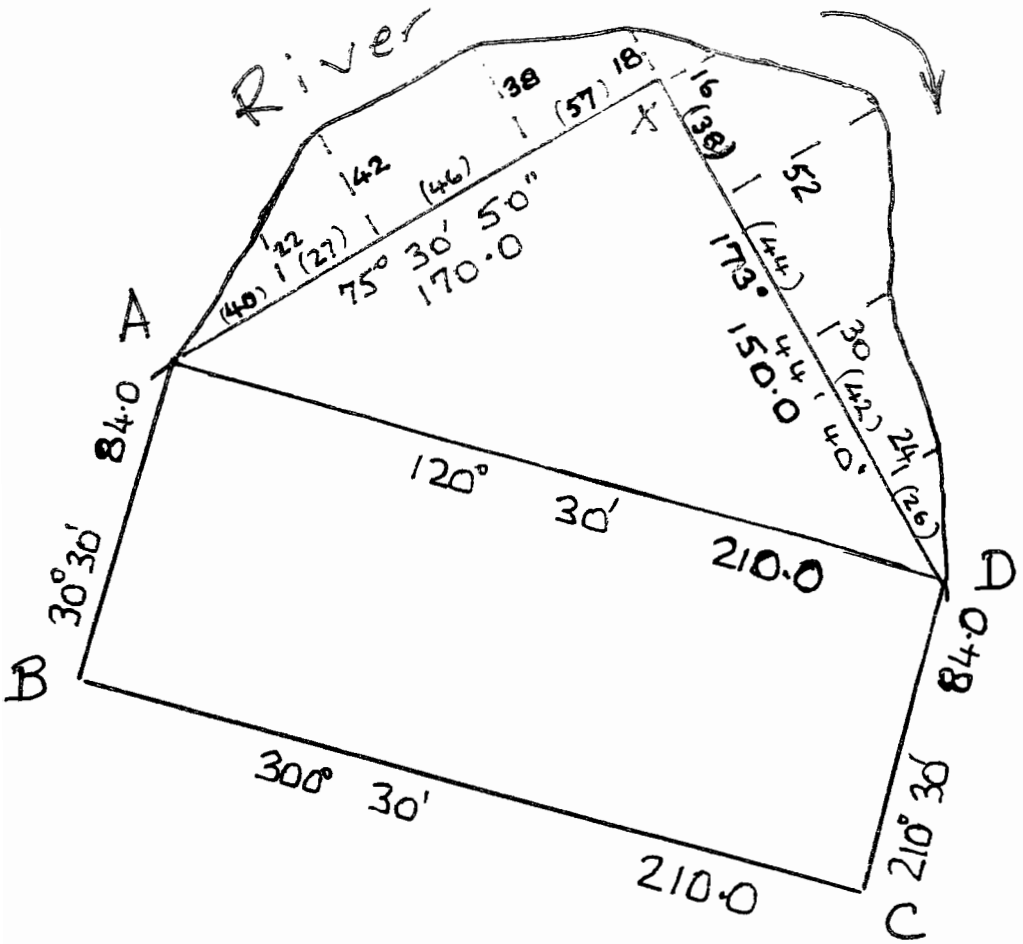
To do this, two survey lines were run from A to D via X and offsets measured from each of those lines to the river bank at appropriate points, as shown.

Determine the total area of Lot 1 **(1 Mark)** by calculating

a) **(2 Marks)** the area within the regular shape comprised of the straight lines connecting A B C and D,

b) **(3 Marks)** the area within the triangle A D X, and

c) **(6 Marks)** use the trapezoidal rule to calculate the 'offset' area between the lines AX, XD and the river bank.



ANSWERS

a) Area inside lines A B C D .....

b) Area inside A D X .....

c) Offset area .....

d) Total area of land .....

P.T.O.

QUESTION 6 (10 Marks)

The plan on the next page shows a contour plan of the existing ground of a proposed factory site. Within that block, an area of land A B C D is to be filled to provide a base for the building. The numbers underlined in each corner indicate the R.L. that the site must be filled to at that location. On top of that, a depth of 0.3m of sand will then be laid.

At the western and northern ends of the site, vertical retaining walls will be built.
On the southern side an embankment running the full length of the site will commence 9.5m away from C then narrow evenly back to exactly meet point B.

Use the information on the plan supplied to calculate:-

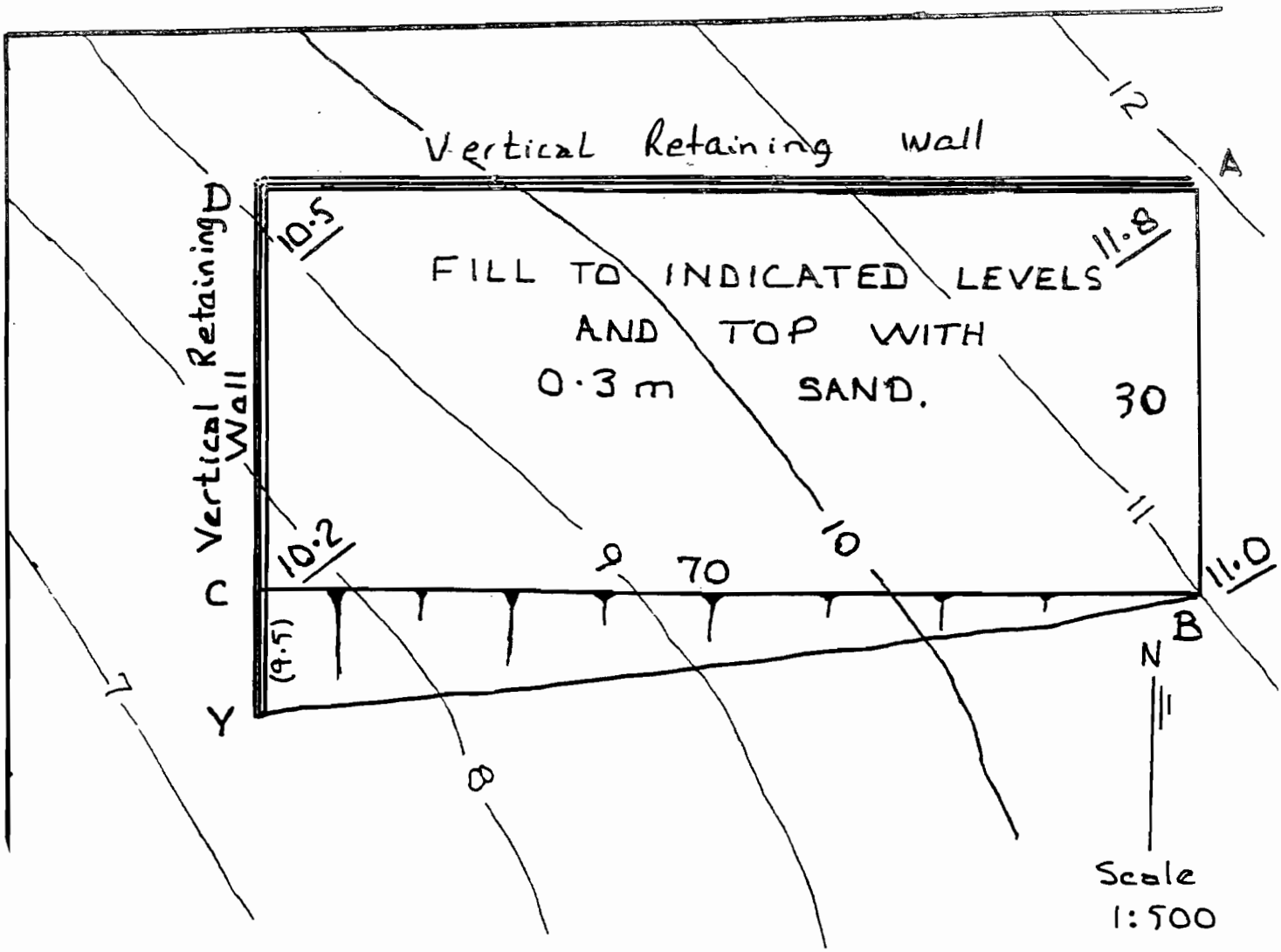
a) **(4 Marks)** the volume of material required to fill the rectangular area ABCD
b) **(4 Marks)** the volume of material needed to fill the embankment C, Y, B
c) **(2 Marks)** the volume of sand required

Volume of material required for ABCD .....

Volume of material needed to fill the embankment C, Y, B .....

Volume of sand required cut .....

P.T.O.


Vertical Retaining wall
12
A
D
10.5
FILL TO INDICATED LEVELS
11.8
AND TOP WITH
0·3 m SAND.
30
C Vertical Retaining Wall
10.2
9
70
10
11
11.0
C
(9.5)
B
N
Y
7
8
Scale
1:500

P.T.O.

QUESTION 7 (12 Marks)

a) **(3 Marks)** At what stages in the construction a multi–storey building would the builder need to engage the services of a Registered Surveyor?

b) (3 Marks) Briefly explain what a "Total Station" is.
Also explain what is meant when they are said to work in "reflectorless" mode.

P.T.O.

c) **(3 Marks)** What education and training is required to become one of the only people allowed, by law, to undertake cadastral surveys and what are Cadastral Surveys?

d) (3 Marks) Rotating lasers are now used in land forming construction works such as playing fields, car parks, irrigation and farming works.
Explain the advantages of using a rotating laser for these works compared to the traditional level and staff.

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

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

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

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

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

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

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

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

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

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

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

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

$$RL_S = RL_T + HI + V - m$$

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

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

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

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

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

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

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

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

$$Chord = 2R\sin\delta$$

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

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

$$Area = \pi R^2$$

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

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

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

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

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

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

Volume of Cylinder
$= \pi r^2 h$

Volume of Pyramid
$= 1/3$ Base Area $\times$ Perpandicular Height
$= 1/3\ A.h$

Volume of Cone
$= 1/3\ A.h$