

**UNIVERSITY OF SOUTH AUSTRALIA**

DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING AND THE  
ENVIRONMENT

School of Geoinformatics, Planning and Building

Semester 1, 1999

**Surveying Science 1 : 09103**  
**Surveying Science 1A (Surveying Stream) : 10241**

Time Allowed : 3 hours + 10 minutes reading time

**General Instructions to Candidates**

Total Marks = 120

Attempt ALL questions.

Marks for questions shown in brackets.

Please ensure front of answer book is completed with your name, student I.D. number, course and section of the examination (if applicable).

**QUESTION 1**

- (a) Define the following levelling terms :  
 i) AHD;  
 ii) Height of collimation; and  
 iii) A horizontal line. (6)
- (b) Briefly describe the effect of parallax, and the procedure for its adjustment in a level. (5)
- (c) An automatic level was tested for collimation error by the two peg test. Determine the magnitude and sign of the collimation error from the test data below :

Instrument Position	BS	FS	Remarks
Midpoint of line XY	1.317		X
		1.586	Y
Near X on XY extended	1.492		X
		1.773	Y

- The distance XY is 50 metres. (5)
- (d) Comment on the magnitude of the collimation error determined in (c) above. (2)
- (e) A levelling loop of 3.5 km in length has been performed. What is the allowable misclosure (in mm) if a 3<sup>rd</sup> order standard of accuracy is required? (2)

**QUESTION 2**

- (a) Reduce the following levelling observations using the rise and fall method :

BS	IS	FS	Chainage (m)	Remarks
1.587				TBM2
1.369		1.405		Change point
	*2.024			Underside of bridge
	1.648		85.2	A (centreline of road)
1.832		1.460		Change point
	*2.716			Overhead pipe
	*2.603			Underside of balcony
	2.249		131.0	B (centreline of road)
1.217		1.386		Change point
		1.751		TBM2

\*denotes inverted staff reading

- The reduced level of TBM2 is 35.264 m. (14)
- (b) Determine the gradient of the road from A to B levelled in (a) above (express the result as both a percentage and a rate). (3)
- (c) Given that the magnetic declination was 5° 20' East in 1985 (2' 30" East/year), determine the magnetic bearing of a line calculated to be 311° 24' true in 1999. (3)

**QUESTION 3**

- (a) Describe the reiteration and repetition methods of horizontal angle reading, including examples of booking and reduction procedures. (12)
- (b) Describe, with the aid of a diagram, the test for horizontal collimation error in a theodolite. (3)
- (b) In the context of EDM, describe the differences between electro-optical and microwave systems. (5)

**QUESTION 4**

- (a) The coordinates of three points D, E and F are :

Point	East	North	RL
D	263.409	379.554	70.636
E	324.719	415.926	38.922
F	378.254	374.972	63.284

Compute the slope distances DE and EF. (7)

- (b) Point Z is situated on the upper corner of a building being surveyed. A bearing, vertical angle and slope distance were observed from a total station instrument at station B to point Z. Determine the coordinates and reduced level of point Z given the survey and control information below :

Height of instrument above station B = 1.538 m  
 Bearing BZ =  $308^{\circ} 12' 40''$   
 Vertical angle FL =  $83^{\circ} 41' 20''$   
 FR =  $276^{\circ} 18' 10''$   
 Slope distance = 25.306 m

**Control Data**

Coordinates of station B are E = 168.492, N = 211.376  
 Reduced level of station B is 76.592 m (7)

- (c) Determine the coordinates of the points M and N in the triangle shown below, given that the bearing of the line LM is  $290^{\circ} 00'$  and the coordinates of L are E = 200.000, N = 300.000. (6)

**QUESTION 5**

Use the survey and coordinate information below to calculate :

- i) the adjusted coordinates of all traverse points (using Bowditch adjustment); and  
 ii) the linear misclosure and precision of the traverse.

Observed Angles	Distance
A $91^{\circ} 50' 15''$	AB 213.848
B $110^{\circ} 02' 30''$	BC 234.176
C $57^{\circ} 11' 45''$	CD 306.563
D $100^{\circ} 54' 50''$	DA 152.432

**Control Data**

Bearing AB =  $63^{\circ} 35' 30''$   
 Coordinates of point A :  
 E = 500.000, N = 500.000

(20)

**QUESTION 6**

- (a) An unoriented traverse connects two points Q and T as shown below. Using the survey and coordinate information provided, determine :
- i) the adjusted bearings and distances for the lines QR, RS and ST; and
  - ii) the adjusted coordinates of points R and S.

**Control Coordinates**

<i>Point</i>	<i>East (m)</i>	<i>North (m)</i>
Q	1500.530	1251.605
T	829.373	1073.059

An assumed bearing of the line QR is  $150^{\circ} 00'$ . **(15)**

- (b) Using the coordinates from (a) above, determine the area contained within the Figure QRSTQ (express the result in square metres and hectares). **(5)**