THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY - LEVEL 3
FINAL EXAMINATION - 2008/09

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CEX3233 - SURVEYING I

Time allowed: Three hours

Date: Monday, 09th March 2009 Time: 0930 - 1230 hours

Answer **any five** questions. All questions carry equal marks.

If you have answered more than five questions (either partly or in full), cross out the extra answers. Otherwise, only the first five answers appearing in the answer book will be evaluated.

1. (a) Briefly explain the differences between a systematic error and a random error. Give examples for both.

   (b) A survey line was measured in four spans using a steel band, by pulling from its ends without allowing it to touch the ground. The observations in Table 1 were recorded.

Table 1

Span	Measured Length, m	Reading on Spring Balance, kgf	Level Difference Between Ends, m
1	29.655	15.0	2.35
2	29.340	15.0	3.20
3	29.235	12.0	1.80
4	16.410	12.0	0

The steel band had a mass of 0.030 kg/m. It had been standardised on a flat surface at a temperature of 20°C under a pull of 100 N, and found to be 29.993 m long. If the field temperature at the time of measurement was 29°C, find the true length of the survey line.

Young's modulus of steel = 207 kN/mm^2
Coefficient of linear expansion of steel = 1.15 x 10^{-5} per °C
Area of cross section of steel band = 3.60 mm^2

2. (a) In plane table surveying details to be surveyed are sighted through the pair of vanes provided on the alidade, but the corresponding rays are drawn along the ruling edge, which does not coincide with the line of sight. Using a clear diagram, explain whether or not this will affect the location of such detail on the plan.

   (b) Comment on the important differences between a theodolite traverse survey and a compass traverse survey.

3. (a) Explain why you make an equal number of rounds of observations on face left and face right when measuring a horizontal angle using a theodolite. Is it necessary that you always swing the telescope clockwise while making observations on face right, and anticlockwise when on face left? Give reasons.

   (b) How should the trunnion or transit axis of a theodolite be positioned? Describe a simple procedure to check whether the trunnion axis satisfies this requirement, and if not, explain how you make the necessary adjustment.

4. In order to find the coordinates of four points A, B, C and D a traverse survey was conducted between two known stations X and Y whose coordinates are [88.61 m North, 121.02 m East] and [367.94 m North, 75.30 m East] respectively, using the four unknown points as intermediate stations. The lengths and bearings given in Table 2 have been recorded.

Table 2

Line	Whole Circle Bearing	Length, m
XA	31° 25' 00"	82.56
AB	56° 18' 20"	100.72
BC	8° 50' 00"	95.85
CD	312° 33' 00"	128.14
DY	254° 06' 30"	96.20

It is suspected that a mistake of 2 m has been made in recording the length of one line. Find the line in which this mistake has occurred. After correcting the mistake, compute the coordinates of points A, B, C and D.

5. A tilting level, which was in good adjustment, was set up at a point P and the following readings were taken on a vertical staff placed at A, B and C respectively: *0.780, 1.255 (on inverted staff), 1.060.* The level was then moved to a point Q, and the following readings were taken on the vertical staff placed at C, D and E respectively: *1.310, 0.985, 1.115.*
After moving the level to a point R, the following readings were taken on the vertical staff placed at E and F respectively: *0.840, 0.675.*

Show the above information on a sketch, and explain the meanings of *back sight, inter sight, fore sight and change point.*

Book and reduce the levels using a standard method, taking the reduced level of A to be 21.02 m above Ordnance Datum.

6. What is meant by *contour interval*? Describe how certain factors influence the selection of a contour interval for a particular survey.

One use of contour plans is to obtain the intersection between two surfaces. With the help of a clear diagram, show how you would find the trace along which the face of a dam intersect with the ground.

7. Describe a simple method by which the constants of a tacheometer could be determined in the field.

Two points A and B lying on a plane hillside were observed using a tacheometer set up at a station P facing the hill. The graduated staff was held vertically at A and B, and the observations in Table 3 were recorded.

Table 3

Inst. Stn.	Staff Stn.	Hor. Circle	Ver. Circle	Stadia Readings, m	Middle Reading, m
P	A	33° 20'	+ 6° 40'	1.700 0.820	1.260
P	B	75° 00'	+11° 00'	2.340 1.100	1.720

If the tacheometer had an anallactic lens of constant 100, find the horizontal distance between points A and B and the gradient of the line AB.

8. Levels taken along an 800 m length of straight line lying on a hillside are shown in Table 4.

Table 4

Distance, m	0	100	200	300	400	500	600	700	800
Red. Level, m	50.03	55.41	58.18	62.30	63.90	64.09	68.04	69.12	70.03

A cutting is to be made for a line of uniform slope passing through the first and the last points. Find the gradient of this line.

If this line is to form the centre line of a new road with a 15 m wide formation and side slopes of 1 in 1.5, find the volumes of cut and fill involved. The transverse slope of the natural ground is 1 in 7.5.