THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY - LEVEL 3
FINAL EXAMINATION - 2007/08

CEX3233 - SURVEYING I

Time allowed: Three hours

Date: Wednesday, 23rd April 2008 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) Explain how you would set out the perpendicular to a chain line from an outside point using a linen tape and ranging poles only. Show how the same task is carried out if an optical square is available.

   (b) A bay of a chain line was measured using a steel band in catenary. The standard pull of 100 N was applied at the two ends which had a level difference of 3.2 m. The atmospheric temperature at the time of measurement was 8°C higher than the standard temperature. If the measured length was 29.715 m, find the correct length of the span.

   Coefficient of linear expansion of steel = 1.15×10^{-5} per °C
   Mass per metre length of steel band = 0.028 kg

2. (a) Indicate the steps in levelling a theodolite prior to measuring angles.

   (b) Explain why you make several rounds of observations, with different initial readings, when measuring a horizontal angle using a theodolite.

   (c) Outline in sequence all the steps that you would take in setting out a clockwise horizontal angle of 32° 48' 20" at a point with reference to a known direction, using a 20" theodolite.

3. In order to determine the coordinates of four points P, Q, R and S, a traverse survey was conducted between two known stations A (88.610 m North, 121.020 m East) and B (367.940 m North, 75.300 m East), using the four unknown points as intermediate stations. The lengths and bearings given in Table 1 have been recorded.

Table 1

Line	Whole Circle Bearing	Length, m
AP	31° 25' 00"	82.560
PQ	56° 18' 20"	100.720
QR	8° 44' 40"	93.850
RS	312° 33' 00"	128.140
SB	254° 06' 30"	96.200

Find the corrected coordinates of the four stations P, Q, R and S. Also, find the length and bearing of the direct link from Q to B.

4. The rail levels on an existing track were checked at points A, B, C, D, E, F and G at 50 m intervals. The following staff readings were recorded.

From instrument position 1: 2.30 (Bench Mark), 1.26 (A), 1.08 (B), 0.89 (C) and 0.69 (D)
From instrument position 2: 1.64 (D), 1.43 (E), 1.22 (F) and 1.01 (G)

The bench mark was 40.40 m above Mean Sea Level. Book the above readings and reduce them using the rise and fall method. Apply the relevant checks. Also, find the amounts by which the rail has settled at intermediate points from a uniform gradient, assuming that there was no settlement at A and G.

5. (a) List the advantages and disadvantages of plane table surveying as compared to other methods of land surveying. Using a clear diagram, explain how you would survey a site by the method of radiation using the plane table.

(b) In a compass traverse ABCDA, the forward and back bearings of lines have been measured, and presented in Table 2.

Table 2

Line	Forward Bearing	Back Bearing
AB	74° 30'	256° 10'
BC	107° 30'	286° 30'
CD	225° 00'	45° 00'
DA	306° 50'	126° 10'

Find the correct bearings of the traverse lines.

6. The observations given in Table 3 were made on a graduated staff placed at a point A, normal to the line of sight, from two instrument stations P and Q. All heights and staff readings are in metres.

Table 3

Inst. Stn.	Inst. Height	W.C.B. of Line of Sight	Vertical Circle	Stadia Readings	Middle Reading
P	1.42	151° 30'	+ 4° 30'	0.960 2.280	1.620
Q	1.48	88° 20'	- 5° 20'	0.980 2.540	1.760

The instrument has additive and multiplication constants of 0 and 100 respectively. Find the horizontal distance between the two instrument stations. If the reduced level of the lower instrument station was 55.220 m above Mean Sea Level, find the reduced levels of the other station and the staff position.

7. The latitudes and departures given in Table 4 have been computed for a traverse using the measured lengths and adjusted angles. Find the area enclosed by the traverse in hectares, and also in acres, roods and perches.

Table 4

Line	Latitude, m	Departure, m
AB	- 146.21	28.49
BC	- 51.90	- 121.91
CD	143.10	- 102.08
DE	102.39	94.02
EA	- 47.38	101.48

3. (a) What do you understand by the term 'contour interval'? Indicate the factors that influence the selection of a contour interval for a particular survey.

(b) The information given in Table 5 was obtained from a contour survey of a reservoir site.

Table 5

Elevation of Contour (m)	Area Enclosed by Contour (ha)
94	31.450
92	20.590
90	12.240
88	6.095
86	2.750
84	1.860
82	1.000

The lowermost point on the reservoir bed had an elevation of 80 m. Draw a curve of volume of water stored in the reservoir versus surface level, and find the elevation of the spill of the dam if the reservoir capacity is required to be 1.1 million cubic metres. You may use the end area rule to calculate volumes.