00199

THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY – LEVEL 3
FINAL EXAMINATION – 2010/11

CEX3233 – SURVEYING I

Time allowed: Three hours

Date: Wednesday, 02nd March 2011 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 survey line was measured in five spans at an elevation of 900 m above mean sea level (MSL).* The steel band was pulled from its ends without allowing it to touch the ground or any other obstacle. The following observations were recorded.

Span	Measured Length, m	Reading on Spring Balance, kgf	Level Difference Between Ends, m
1	29.825	15.0	—
2	29.430	15.0	—
3	29.555	12.0	4.20
4	29.220	12.0	3.60
5	18.320	12.0	2.05

The steel band had a mass of 0.028 kg/m. It has been standardised on a flat surface at a temperature of 20 °C and a pull of 100 N, and found to be 30.006 m long. If the field temperature at the time of measurement was 27 °C , find the true length of the survey line.

Young's modulus of steel = 206 kN/mm²
Coefficient of linear expansion of steel = 1.15×10^{-5} per °C
Cross sectional area of steel band = 2.40 mm²

The magnitude of the correction for height above MSL may be taken as 0.0001575 H metres for every 1000 m, where H is the height in metres above MSL.

2. Answer any three of the following.

(a) What do you understand by the sensitivity of a level tube? Two level tubes have their sensitivities marked as 2mm = 10" and 2mm = 30". Which one is more sensitive? Why?

(b) Explain why accidental errors are not considered as serious as gross errors or systematic errors.

(c) Why is it necessary to make the triangles formed by chain lines well conditioned, that is, the angles are not very small or very large?

(d) Why is it necessary to measure the bearings of survey lines in a compass traverse at both ends?

3. The following particulars refer to three traverse surveys conducted using a theodolite, where the angles between consecutive legs and the length of each leg are measured.

   (a) Traverse PQRSP starting and ending at the same station, with the bearing of PQ measured.
   (b) Traverse ABCDE conducted between two points A and E whose coordinates are known, and bearings of AB and DE measured.
   (c) Traverse AXYZ starting from point A whose coordinates are known, and ending at an unknown point Z, and the bearing of AX measured.

   Which of the above three are closed traverses? List the steps that you would follow in order to find the coordinates of the stations in each of the three traverses.

4. (a) State the important differences between a theodolite traverse survey and a compass traverse survey. List the instruments required to conduct the two types of survey.

   (b) Explain how you would check and adjust the positioning of the trunnion axis of a theodolite.

   (c) The collimation axis in a certain theodolite is known to be not perpendicular to its trunnion axis. If this theodolite is used to measure a horizontal angle without making necessary adjustment, how will the angle be affected?

5. A and B are two points 90 m apart. A level was set up at C, between A and B, in a position 30 m from A. Readings of 1.137 m and 1.460 m were observed on a staff placed at A and B respectively. The level was then moved 30 m towards B to a new position D, and the readings observed on the staff placed at A and B were 1.430 m and 1.697 m respectively. The instrument stations and staff stations were on the same straight line.

   Find the collimation error of the level and the true level difference between A and B. What would have been the four staff readings if the instrument was in proper adjustment?

6. (a) Briefly describe the functions of each of the accessories used in plane table surveying.

   (b) In plane table surveying we observe distant objects through the pair of vanes in the alidade, but draw the corresponding line (ray) along the ruling edge which does not coincide with the line of sight. Explain, with the help of a diagram, how this would affect the plan drawn.

7. What is an anallactic lens in a tacheometer?

   Two points A and B located on a hillside were observed using a tacheometer consisting of an anallactic lens (constant 100). The instrument was set up at a station P facing the hill. The staff was swung forwards and backwards, thus enabling the observer to record the lowest set of readings.

Inst. Stn.	Staff Stn.	Hor. Circle	Ver. Circle	Stadia Readings (m)		
P	A	105° 00'	+ 9° 30'	0.880	1.360	1.840
P	B	148° 20'	+ 10° 40'	0.910	1.540	2.170

   Find the horizontal distance between points A and B, and their reduced levels if the reduced level of station P was 60.22 m, and the instrument height was 1.55 m.

8. Levels taken along 1 km of straight line on a hillside are given in the table below.

Dist., m	0	100	200	300	400	500	600	700	800	900	1000
R.L., m	45.20	50.42	54.50	57.85	60.92	64.33	65.88	68.18	69.20	73.36	76.30

It is proposed to make a cutting for a line of uniform slope passing through the existing ground points at zero and 800 m. Find the slope of this line.

This line is to be used as the centre line of a new road having a 16 m wide formation and side slopes of 1 in 1 in both cut and fill. Calculate the volumes of cut and fill involved. The transverse slope of natural ground is 1 in 8.