00171

THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY - LEVEL 3
FINAL EXAMINATION - 2012/13

CEX3233 - SURVEYING I

Time allowed: Three hours

Date: Wednesday, 24th July 2013 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 why an equal number of rounds of observations are made on each face of a theodolite when measuring a horizontal angle.

   Is it necessary that the telescope of a theodolite must be always turned in the clockwise direction while making observations on face right, and in the anticlockwise direction when on face left? Give reasons.

   (b) What is meant by the term *sensitivity* of a level tube? If two level tubes have their sensitivities marked as *2mm = 10"* and *2mm = 30"*, which one is more sensitive? Give reasons.

   (c) Explain the meaning of *contour interval*. What factors determine the most suitable contour interval for a particular survey?

2. (a) The internal angles in a traverse ABCDEA (named in the anticlockwise direction) measured using a theodolite were as follows.
   A = 123° 00' 20", B = 105° 23' 20", C = 72° 44' 00", D = 88° 29' 00" and E = 150° 22' 20".

   Adjust the angles if necessary, and find the whole circle and reduced bearings of the sides of the traverse if the line AB is running in the southwest direction.

   (b) Briefly explain how Bowditch's correction is applied to a closed traverse,
   (i) by adjusting latitudes and departures, and
   (ii) by adjusting the coordinates.

3. (a) Explain the principal differences between a theodolite traverse and a compass traverse with particular reference to the fieldwork and the accuracy that can be achieved.

   (b) The compass bearings measured at the two ends of each line in a traverse ABCDA are given below.

| Line | Fore bearing | Back bearing |
|---|---|---|
| AB | 64° 00' | 245° 45' |
| BC | 96° 00' | 274° 45' |
| CD | 215° 15' | 35° 15' |
| DA | 290° 00' | 109° 30' |

   Find the stations at which local attraction has been encountered, and determine the true bearings of all sides of the traverse.

4. Describe, with the help of clear diagrams, how testing and adjusting is carried out on the
   (a) trunnion axis of a transit theodolite, and
   (b) collimation axis of a tilting level.

5. As it was suspected that the rails have settled in a certain stretch of a track, the levels on the rails were checked at points A, B, C, D, E, F, G, H, I, J and K situated at 50 m intervals. The following staff readings were recorded.

   From instrument position 1: 1.85 (Benchmark), 1.60 (A), 1.32 (B), 1.03 (C)
   From instrument position 2: 2.06 (C), 1.75 (D), 1.47 (E), 1.17 (F), 0.86 (G)
   From instrument position 3: 2.33 (G), 2.02 (H), 1.73 (I), 1.42 (J), 1.10 (K)

   The reduced level of the benchmark was 52.30 m. Book the above staff readings, and reduce them using *Rise and Fall* method. Apply the relevant checks.

   Find the amounts by which the rail has settled from a uniform gradient at intermediate points, assuming that there was no settlement at A and K.

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

   In order to find the horizontal distance between two points X and Y lying in a hilly area and their reduced levels, tacheometric observations were made to them from two stations A and B of a traverse run at the bottom of the hill. The point X was visible from station A and Y from station B. The staff was swung forwards and backwards, thereby enabling the observer to record the lowest set of readings. The instrument was anallactic with a constant of 100.

| Instrument station | A | B |
|---|---|---|
| Coordinates of station (m) | 76.30 N, 84.88 E | 65.42 N, 120.40 E |
| Reduced level of station (m) | 73.50 | 70.70 |
| Instrument height (m) | 1.52 | 1.60 |
| Staff station | X | Y |
| Whole circle bearing | 24° 30' | 81° 00' |
| Vertical circle | (+) 12° 30' | (+) 9° 50' |
| Stadia readings (m) | 1.180 1.430 1.680 | 1.320 1.630 1.940 |

   Find the horizontal distance XY and the reduced levels of X and Y.

7. A traverse PQRSP runs along the straight line boundaries of a plot of land. After adjusting the internal angles and correcting the lengths of sides of the traverse the following latitudes and departures of the traverse lines have been computed. Find the area of the plot of land in hectares.

| Line | Latitude, m | Departure, m |
|---|---|---|
| PQ | (−) 51.39 | (+) 72.05 |
| QR | (+) 47.33 | (+) 51.55 |
| RS | (+) 51.11 | (−) 23.86 |
| SP | (−) 47.05 | (−) 99.74 |

   The land borders a road along its boundary PS. This land is proposed to be partitioned into two blocks of equal extent with a straight line boundary XY, where X lies on PS and Y lies on QR. The block lying to the north is required to have a road frontage of 70 metres. Show how the land is partitioned, by giving the locations of X and Y.

8. The following levels have been obtained along a 1 km length of a straight line on a hillside.

| Dist., m | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R.L., m | 60.25 | 65.25 | 68.71 | 72.28 | 75.90 | 79.58 | 82.47 | 85.55 | 88.51 | 91.27 | 92.25 |

It is proposed to make a cutting for a line of uniform gradient passing through the existing ground at 0 and 1000m. Find the gradient of this line.

This line is to form the centre line of a new road with a 12 m wide formation and side slopes of 1 in 1.5 in both cut and fill. Find the volumes of excavation and embankment involved. The lateral slope of natural ground is 1 in 6.