

THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY – LEVEL 3
FINAL EXAMINATION – 2005/06



CEX 3233 – SURVEYING I

Time allowed: Three hours

Date: Thursday, 27th April 2006

Time: 0930 – 1230 hours

Answer **any five** questions. All questions carry equal marks. *If you have answered more than five questions (either partly or fully), cross out the extra answers. Otherwise, only the first five answers appearing in the answer book will be evaluated.*

1. The length of a base was measured using a 30 m steel band, which was suspended clear of the ground, in three spans. The measured lengths and the slope of the line joining the two end supports of the tape are as follows.

	Span 1	Span 2	Span 3
Measured length (m)	29.855	29.770	20.630
Slope	5° 30'	3° 00'	Level

The standard pull of 100 N was applied on the field for the last two spans while a greater pull of 160 N was required for the first span in order to prevent the tape from touching some bushes. The atmospheric temperature was 9 °C above the standard temperature. Find the true length of the base, given the following properties relating to the steel band.

Mass	= 0.0232 kg/m
Cross section area	= 2.35 mm ²
Young's modulus	= 206 kN/mm ²
Coefficient of linear expansion	= 1.15 x 10 ⁻⁵ per °C

2. Using clear diagrams, describe two of the following.

- Testing and adjusting the trunnion (transit) axis of a theodolite.
- Testing and adjusting the vertical cross hair in the telescope of a theodolite (horizontal collimation adjustment).
- Testing and adjusting the collimation axis of a tilting level.

3. The following bearings (computed from adjusted angles) and the corrected lengths have been obtained in a closed traverse ABCDEA. The lengths of traverse lines BC and DE could not be measured.

Line	Whole Circle Bearing	Length (m)
AB	55° 48' 55"	78.24
BC	161° 46' 52"	—
CD	225° 42' 24"	84.64
DE	296° 13' 41"	—
EA	39° 18' 06"	81.64

Determine the missing lengths of the lines BC and DE. Also find the bearing and length of line AD.

4. (i) What are the situations in which plane table surveying can be used effectively? State the disadvantages of plane table surveying as compared to other methods of surveying.
- (ii) Describe in detail, using diagrams where necessary, how you would survey a given area using a plane table and its accessories.

5. A tilting level, which is in proper adjustment, was set up at point 1 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 point 2 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 point 3, 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 briefly explain the meanings of back sight, inter sight, fore sight and change point. Book, reduce and check the levels using one of the standard methods, considering the reduced level of A to be 21.02 m AOD.

6. (i) Describe the main differences between a *systematic error* and an *accidental error* with respect to how they occur, their effects on the result, and how to overcome such effects.

- (ii) Classify the following errors under systematic, accidental or gross errors, giving reasons.

- The included angles of a traverse with six sides have been measured, and their sum is found to be $721^{\circ} 00' 00''$.
- The length of a line has been measured along sloping ground.
- A building, which is nearly parallel to a chain line and plotted from offsets, is found to be much shorter than its actual length.

7. State the common principle adopted in different methods of tacheometric observations. What are the differences in procedure adopted in the two methods of each pair below?

- (i) 'fixed hair' and 'movable hair' methods of stadia tacheometry.

- (ii) 'movable hair' method of stadia tacheometry and 'subtense bar' method of tacheometry.

Two points P and Q lying on a plane hillside were observed with a tacheometer consisting of an anallactic lens ($k = 100$) placed at a point A facing the hill. The graduated staff was held normal to the line of sight.

Inst. Stn.	Staff Stn.	Hor. Circle	Ver. Circle	Stadia Readings (m)		
A	P	$42^{\circ} 20'$	$+ 8^{\circ} 00'$	0.840	1.280	1.720
A	Q	$80^{\circ} 30'$	$+ 12^{\circ} 30'$	1.030	1.650	2.270

Find the horizontal distance between P and Q and the slope of the line PQ.

8. Briefly explain the ways in which the volume of earthwork may be calculated.

Excavation was done for the basement of a building down to a reduced level of 30.0 m, over an area of 40 m x 30 m. The existing ground was levelled on a 10 m grid, and the spot levels (in metres) are given on page 3.

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48.2	45.3	46.0	49.1	50.4
44.4	42.5	43.0	45.2	47.0
40.1	40.1	40.4	44.5	42.3
36.6	35.0	36.2	35.8	37.6

It has been observed that the diagonals marked with broken lines on Fig. 1 make the top surface of each of the resulting triangular prisms into a near plane surface. Calculate the volume of excavation considering vertical earth prisms of triangular cross section.

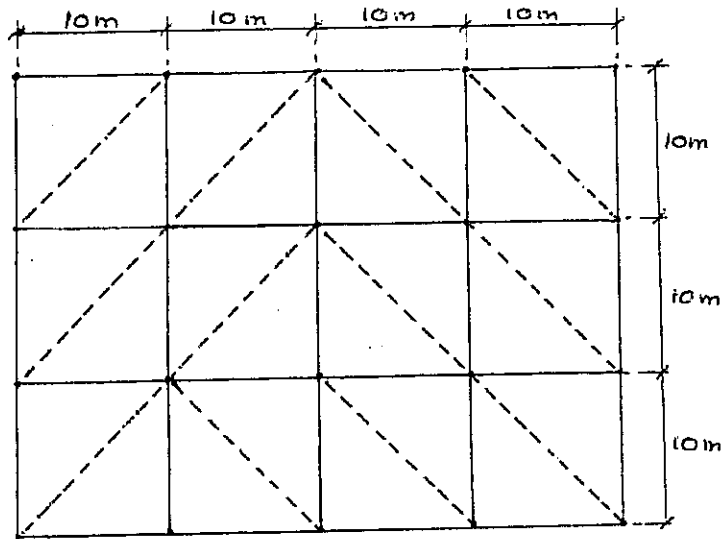


Fig. 1

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