**Birzeit University**

**Civil Engineering Department**

**Surveying for Civil Engineering (CE337) - Final Examination – Part 1 – 50 min**

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**Problem 1 (20%)**

It needed to dig a tunnel on a level ground. The starting height (h) of the tunnel is 1.5 m. The finish elevation of the tunnel runs 70m at a gradient of -1%, then 50 at -2% and another 30 at -1.5%. The figure shows a typical cross section for the tunnel. The side slopes are 1:1 for the left side and 2:1 for the right side and the base width is 10m.

H

1. Find the cross sectional area

At stations 0, 50, 110, 150 (12%)

1. Find the volume of cut and the transported volume knowing that the soil compaction factor is 1.1 using only the 4 cross-sections in part 1(8%)

**Problem 2 ( 15%)**

The table below provides the measured departures and latitudes for a closed traverse.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **AB** | **BC** | **CD** | **DE** |  |
| **ΔE (m)** | 70.85 | -43.62 | - 24.15 | 50.87 |  |
| **ΔN (m)** | -34.72 | -61.35 | 73.35 | 48.22 |  |

1. Find the measured traverse angles at points B, C, and D. (8%)
2. Find the traverse angular error if the known azimuth of the last line is 46° 36' 15''. (3%)
3. Find the corrected azimuths of lines BC and CD. (4%)

**Problem 3 (15%)**

For the triangle, a tachometric survey work was carried out using a Theodolite having a constant K=100 and F+C= 0 and the following measurements were obtained:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Station | Point | H C R(CW) | Zenith Angle | Staff reading (m) | Instrument Height (m) |
| A | C | 0° 0 ’ 0’’ |  |  |  |
| B | 83° 15’ 30’’ | 85° 00’ 00’’ | 4.000 |  |
| B | 83° 15’ 30’’ | 86° 07’ 45’’ | 2.000 |  |
| B | A | 0° 0 ’ 0’’ |  |  |  |
| C | 45° 25’ 45’’ |  |  |  |
| C | A |  | 83° 00’ 00’’ | 1.515 | 1.655 |
| B |  | 95° 00’ 00’’ | 2.005 | 1.655 |

1. Compute the distances AC and BC (8%)
2. Find the elevations of point A and B giving that the elevation of point C is 478.625m (7%)