Question 1 (15 points)

1.1 Define surveying and taping

1.2 What are curvature and refraction errors for horizontal lines departing from the Earth's surface by 500 m, 5 km and 1000 ft.

Solution

1.1

Surveying is defined as art of measuring, recording and then drawing to scale, the size and shape of the natural or manmade objects on the surface of the earth.

Taping consists of applying the known length of a graduated tape directly to a line a number of times to determine its length. (3 points)

1.2

For 500 m=0.5 km

Curvature errors $c = 0.0785\ L^2 \quad = 0.0785 * 0.5^2 = 0.019625$ m

Refraction errors $r = \frac{1}{7}\ 0.0785\ L^2 \quad = \frac{1}{7}\ 0.0785 * 0.5^2 = 0.0028$ m

For 5 km

Curvature errors $c = 0.0785\ L^2 \quad = 0.0785 * 5^2 = 1.9625$ m

Refraction errors $r = \frac{1}{7}\ 0.0785\ L^2 \quad = \frac{1}{7}\ 0.0785 * 5^2 = 0.2804$ m

For 1000ft = 1000*30.48/100*1000=0.304 km

Curvature errors $c = 0.0785\ L^2 \quad = 0.0785 * 0.304^2 = 0.00725$ m

Refraction errors $r = \frac{1}{7}\ 0.0785\ L^2 \quad = \frac{1}{7}\ 0.0785 * 0.304^2 = 0.00104$ m (12 points)

Islamic University Faculty of Engineering Department of Civil Engineering		الجامعة الإسلامية كلية الهندسة قسم الهندسة المدنية

CE271-SURVEYING

Fall Semester 2016-2017

Midterm Exam 1

Exam Date: November 21, 2016; Exam Duration: 90 minutes

Student's Full Name: _____

Student ID #:_____ **Signature:** _____

Instructions:

- **Write your student ID number on the top of each page**
- **Write the solution in the space provided under each question**
- **Show all the details of your analysis and calculations**

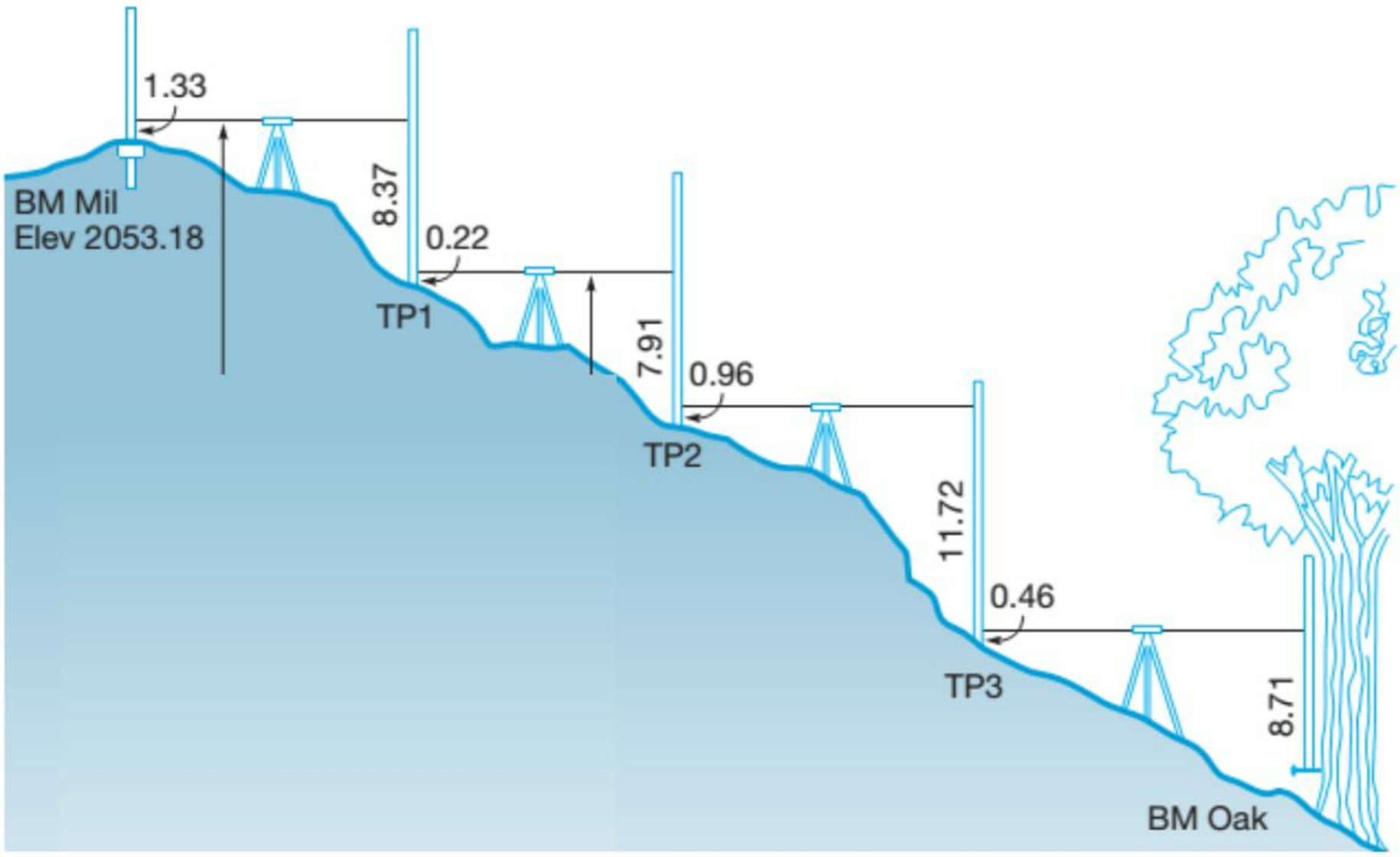
Question No.	Points Assigned	Points Awarded
1.	15	
2.	25	
3.	30	
4.	30	
Total	**100**	

Instructor's Full Name	Dr. Abdelkader Ahmed
Signature	

Question 3 (30 points)

3.1 Define levelling and its objectives

3.2 The following figure shows four instrument setups required to determine a level of Oak tree root starting from a benchmark point at a mill on the hill top. What the type of this levelling. Calculate in a table the elevation of the tree root.



Solution

3.1

Levelling used to incorporate the height feature

Object of levelling:

Find the elevation of given points with respect to a given datum

To establish points at different elevation (5 points)

Question 2 (25 points)

2.1 Explain the methods for measuring distances on uneven or sloping ground

2.2 The slope distance and vertical angle between points A and B were observed with a total station instrument as 100 m and 15º respectively. The device height and rod reading were 1.5 m and 1.74 m respectively. If the elevation of A is 40 m above the sea level, compute the elevation of B and the distance between A and B.

Solution

2.1The methods for measuring distances on uneven or sloping ground

Indirect measurement: In taping on uneven or sloping ground, it is standard practice to hold the tape horizontally and use a plumb bob at one or perhaps both ends.

Direct measurement: In measuring the distance between two points on a steep slope, rather than break tape every few feet, it may be desirable to tape along the slope and compute the horizontal component. (5 points)

2.2 Given: (L_{AB} =100 m, α=15º , hI= 1.5 m , d=1.74 m Elev A=40 m)

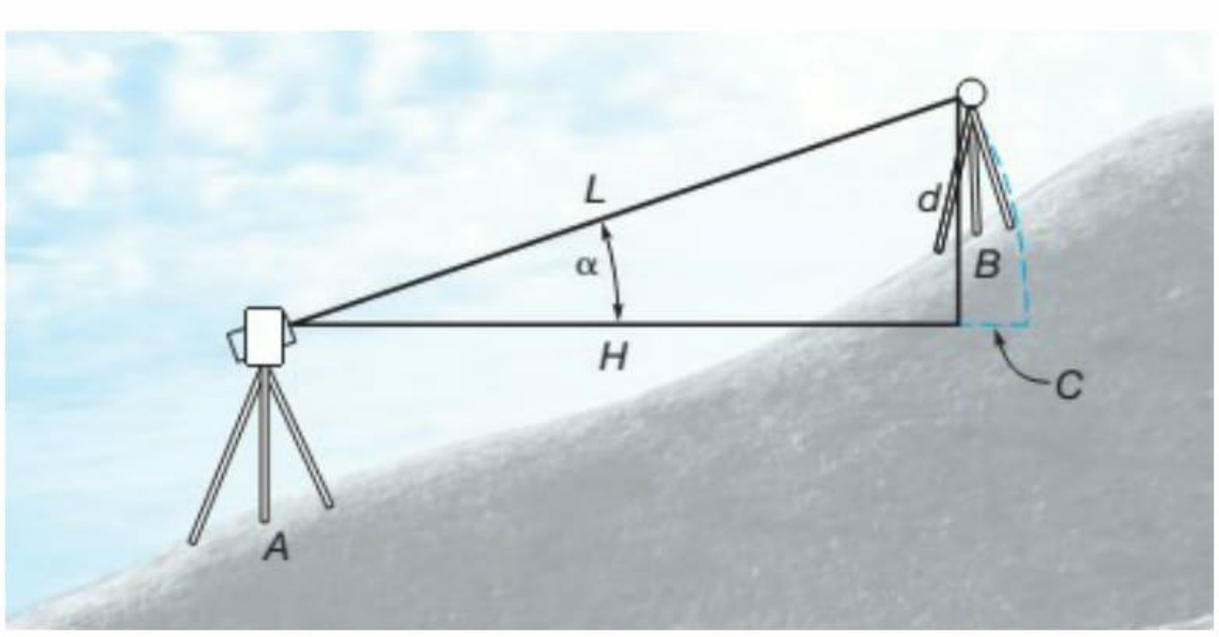
d/L= sin α d= 100*sin 15 = 25.88 m

Elev B= 40+1.5+25.88-1.74 = 65.64 m

$$H = L\cos\alpha$$

H_{AB}= 100 cos 15= 96.59 m

(20 points)



Question 4 (30 points)

4.1 What are the common methods for making linear measurements

4.2 What are the error sources in the linear measurements-give examples

4.3 A 50-m steel tape standardized at 25°C and supported throughout under a tension of 6 kg was found to be 49.9 m long. The tape had a cross-sectional area of 0.075 cm^2 and a weight of 0.04 kg/m. This tape was held horizontal, supported at the ends only, with a constant tension of 10 kg, to measure a line from A to B in three segments. Distances of these segments are 42m, 55m and 26m measured in temperatures of 22°, 25° and 27° respectively. Apply corrections for tape length, temperature, pull, and sag to determine the correct length of the line AB.

Solution

4.1 Linear measurements surveying most commonly use today: Taping, EDM, and Satellite systems (GPS). (3 points)

4.2 There are three fundamental sources of error in taping:

1. Instrumental errors. A tape may differ in actual length from its nominal graduated length because of a defect in manufacture or repair, or as a result of kinks.

2. Natural errors. The horizontal distance between end graduations of a tape varies because of the effects of temperature, wind, and weight of the tape itself.

3. Personal errors. Tape persons setting pins, reading the tape, or manipulating the equipment.

Some types produce systematic errors others produce random errors. (9 points)

3.2 This typed called <u>differential levelling</u> (25 points)

DIFFERENTIAL LEVELS

Sta.	+ B.S.	H.I.	− F.S.	Elev.	Adj. Elev.
BM Mil.	1.33			2053.18	2053.18
		2054.51		(−0.004)	
TP1	0.22		8.37	2046.14	2046.14
		2046.36	7.91	(−0.008)	
TP2	0.96		~~8.91~~	2038.45	2038.44
		2039.41		(−0.012)	
TP3	0.46		11.72	2027.69	2027.68
		2028.15		(−0.016)	
BM Oak	11.95		8.71	2019.44	2019.42

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CE271-SURVEYING

Fall Semester 2016-2017

Midterm Exam 2 (Answer model)

Exam Date: December 28, 2016; Exam Duration: 90 minutes

Student's Full Name: _____

Student ID #:_____ **Signature:** _____

Instructions:

- **Write your student ID number on the top of each page**
- **Write the solution in the space provided under each question**
- **Show all the details of your analysis and calculations**

Question No.	Points Assigned	Points Awarded
1.	40	
2.	30	
3.	30	
Total	100	

Instructor's Full Name	Dr. Abdelkader Ahmed
Signature	

4.3 (18 points)

(a) The tape length correction by the following equation is

$$C_L = \left(\frac{l - l'}{l'}\right) L$$

C_L= ((49.9-50)/50)*(42+ 55+26) = -0.246 m

(b) Temperature corrections by the following equation

$$C_T = k(T_1 - T)L$$

Assume k=0.000011

CT1=0.000011(22-25) 42= - 0.001386 m
CT2=0.000011(25-25) 55= 0
CT3=0.000011(27-25) 26= + 0.000858

c) The pull correction by the following equation is

$$C_P = (P_1 - P)\frac{L}{AE}$$

Assume: E=2000000 kg/cm^2
Cp= [(10-6)/(0.075*200000)]* (42+ 55+26)= +0.00328

d) The sag corrections by the following equation

$$C_S = -\frac{w^2 L_S^3}{24 P_1^2}$$

Cs1= - 0.04^2*42^3/24*10^2 = -0.049
Cs2= - 0.04^2*55^3/24*10^2 =-0.111
Cs3= - 0.04^2*26^3/24*10^2 = -0.012

Finally, corrected distance AB is obtained by adding all corrections to the measured distance
= 42+ 55+26-0.246- 0.001386+0.000858+0.00328-0.049-0.111-0.012= **122.5848 m**