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

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	

Azimuths DE=257 40 01+86 51 01= 344 31 02, ED=344 31 02-180=164 31 02

Azimuths EF=164 31 02+102 09 13= 266 40 15, ED=266 40 15-180=86 40 15

Azimuths EF=86 40 15+103 12 38= 189 52 53, FA=189 52 53-180=9 52 53

Azimuths AB=9 52 53+120 07 07= 130 00 00 (OK)

$$\text{departure} = L \sin \alpha$$

$$\text{latitude} = L \cos \alpha$$

Angles	Corr angles	Azimithus	sides	Latitude	Deptarture
A	120 07 07	130	329.722	-211.94	252.58
B	59 39 07	9 39 07	210.345	207.37	35.26
C	248 00 54	77 40 01	279.330	59.66	272.88
D	86 51 01	344 31 02	283.426	273.14	-75.66
E	102 09 13	266 40 15	433.007	-25.14	-432.28
F	103 12 38	189 52 53	307.625	-303.06	-52.79
A	120 07 07	130			
Total			1843.455	0.03	-0.01

$$\text{linear misclosure} = \sqrt{(\text{departure misclosure})^2 + (\text{latitude misclosure})^2}$$

=0.032

$$\text{relative precision} = \frac{\text{linear misclosure}}{\text{traverse length}}$$

=0.032/1843.455=1.7/100000 ….OK

Question 1 (40 points)

1.1 **State** the steps for making elementary traverse computations and methods of the angle adjusting

1.2 **Compute and tabulate** for the following closed-polygon traverse: (a) adjusted angles and azimuths, (b) linear misclosure, (c) relative precision and (d), adjusted departures and latitudes. (*Note*: Line *AB* bearing is 130º)

Course	Length (m)	Interior Angle (Right)
AB	329.722	*A* = 120°07′10″
BC	210.345	*B* = 59°39′10″
CD	279.330	*C* = 248°00′57″
DE	283.426	*D* = 86°51′04″
EF	433.007	*E* = 102°09′16″
FA	307.625	*F* = 103°12′41″

Solution

1.1 (10 points)

The usual steps followed in making elementary traverse computations are:
1-Adjusting angles or directions to fixed geometric conditions,
2-Determining preliminary azimuths (or bearings) of the traverse lines,
3-Calculating departures and latitudes and adjusting them for misclosure,
4-Computing rectangular coordinates of the traverse stations,
5-Calculating the lengths and azimuths (or bearings) of the traverse lines after adjustment.

The methods applied to adjust angles in the traverse:
1- Applying an average correction to each angle where observing conditions were approximately the same at all stations. The correction for each angle is found by dividing the total angular misclosure by the number of angles.
2-Making larger corrections to angles where poor observing conditions were present.

1.2 (30 points)

Total angles=719 00 18 atandarder anfgles= (6-2)*180= 720
Error= 720 00 18-720= +18 corrections= +18/6= -3

Azimuths AB=130 BA= 130+180= 310
Azimuths BC=310+59 39 07= 369 39 07 -360 =9 39 07, CB=9 39 07 +180=189 39 07
Azimuths CD=189 39 07+248 00 54= 437 40 01 -360 =77 40 01, DC=77 40 01+180=257 40 01

Question 2 - Solution (Cont.)

Whether the mapping is done by ground or aerial methods, the first requirement for any project is good control. The control is classified as either horizontal or vertical.

Horizontal control for a mapping survey is provided by two or more points on the ground, precisely fixed in position horizontally by distance and direction or coordinates. Horizontal control can be established by the traditional ground surveying methods of traversing, triangulation, or trilateration

Vertical control is provided by benchmarks in or near the tract to be surveyed and becomes the foundation for correctly portraying relief on a topographic map. Vertical control is usually established by running lines of differential levels starting from and closing on established benchmarks

2.2 (12 points)

1: gentile slop , 2: steep slop, 3: runoff channel, 4 : valley, 5: valley, 6: hill

2.3 (6 points)

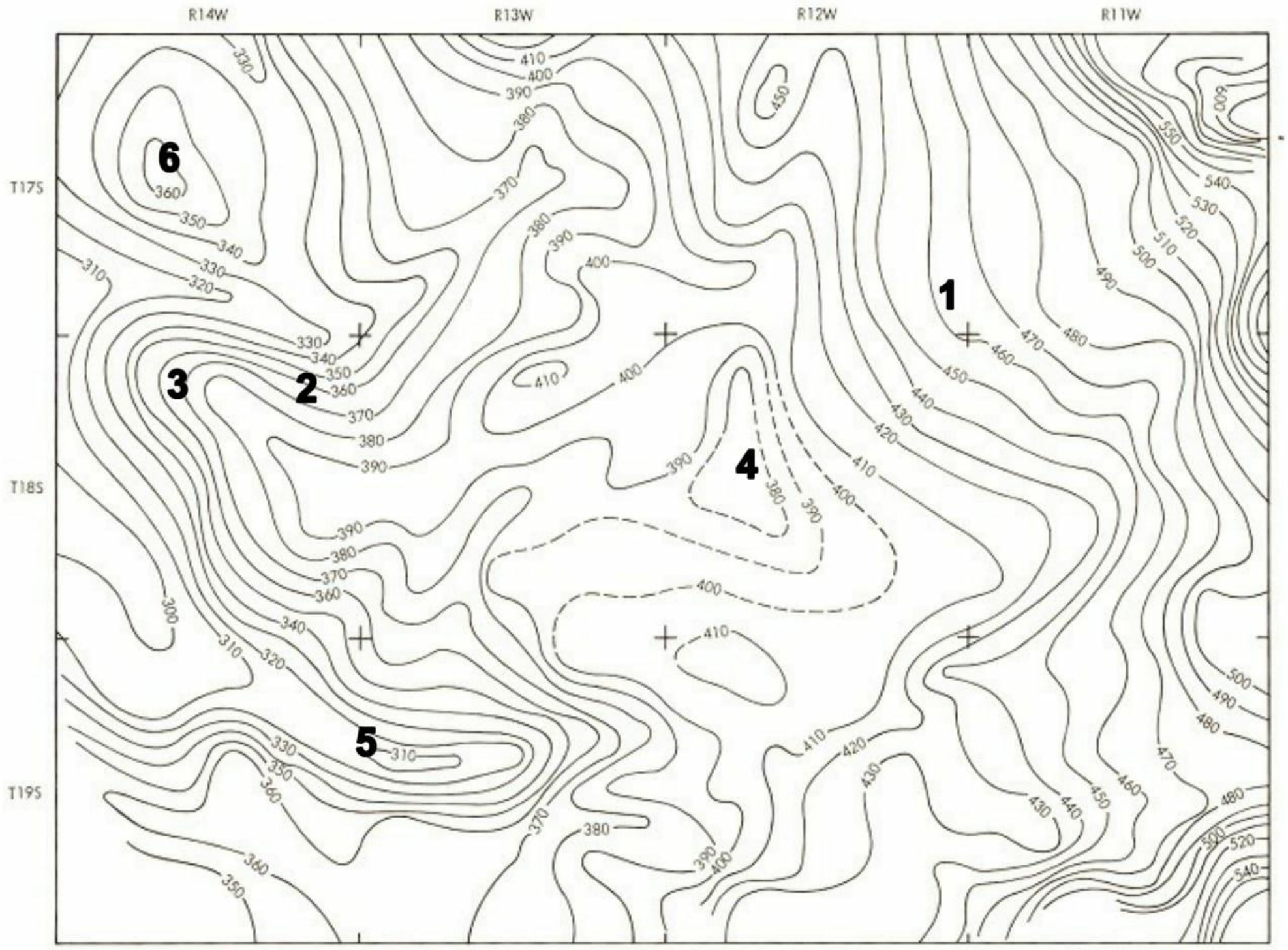
$$Gradient = \frac{Contour\ interval}{Horizontal\ equivalent}$$

For location 1: =10/200= .05 for 2: =10/50=0.5

Question 2 (30 points)

2.1 **Explain** the types of maps and their basic methods and controls

2.2 **State** the characteristics of the contour lines on the following map (follow the numbers on the map)



2.3 **Calculate** ground gradients for locations numbered 1 and 2 on the previous map, if their horizontal equivalent are 200 and 50 m respectively.

Solution

2.1 (12 points)

Two different types of maps:

Planimetric depicts natural and cultural features in the plan (X-Y) views only. Objects shown are called planimetric features.

Topographic maps also include planimetric features, but in addition they show the configuration of the Earth's surface.

Mapping surveys are conducted by one of two basic methods: aerial (photogrammetric) or ground (field) techniques, but often a combination of both is employed.

Question 3 - Solution (Cont.)

X	gx1	$rx^2/2$	Y(eleva)
0	0	0	600
50	100	-10	690
100	200	-40	760
150	300	-90	810
200	400	-160	840
250	500	-250	850
300	600	-360	840
350	700	-490	810
400	800	-640	760
450	900	-810	690
500	1000	-1000	600

3.3 (10 points)

- $\boldsymbol{Length\ of\ curve\ =\ \frac{2\pi R}{360}\Delta}$

(Curve length from T1 to T2)

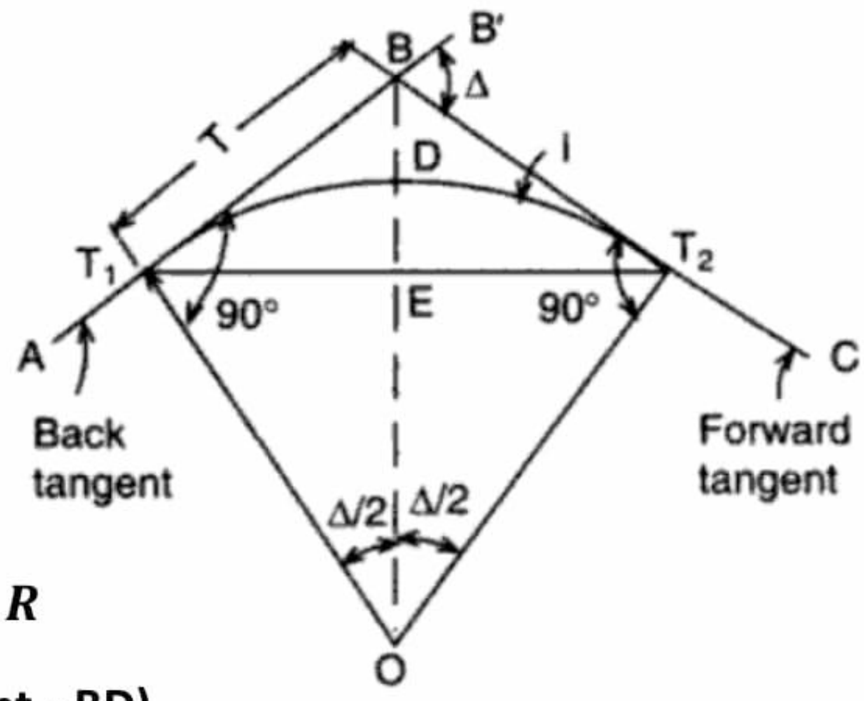
- $\boldsymbol{Tangent\ length\ = R\ tan\frac{\Delta}{2}}$

(Length T1 B or T2 B)

- $\boldsymbol{Length\ of\ long\ chord\ =\ 2R\ sin\frac{\Delta}{2}}$

(Chord T1 and T2)

- $\boldsymbol{External\ distance\ or\ apex\ distance = R\ sec\frac{\Delta}{2} - R}$



(The shortest distance between the curve and intersection point - BD)

- **Major offset** $\boldsymbol{(Mid\ ordinate) = R\left(1 - cos\frac{\Delta}{2}\right)}$

(The distance between mid-point of the long chord and the mid- point of the curve-DE)

R=200 m Δ=50°

Length of curve (T1DT2) = $\frac{2\pi R}{360}\Delta$ **= (2*3.14*200/360)50= 174.44**

(Complete calculating all elements in the same manner)

Question 3 (30 points)

3.1 **Classify** curves in the road construction and **stat** methods of laying out the circular horizontal curve in the field

3.2 A grade of +2.0% intersects with a grade of -2.0% at a vertex point. An equal-tangent parabolic curve 500 ft long has been selected to join the two tangents. The BVC, starting point of the curve, have station and elevation of 40+20 and 600 ft, respectively. **Compute** the curve elevations for stations at every 50ft.

3.3 A circular curve having radius of 200 m and intersection angle of 50º. **Calculate** all the curve elements

Solution

3.1 (10 points)

Horizontal Curves: Simple Curve (Circular Curve), Compound Curve, Transitional Curve, Reverse Curve

Vertical Curves: Summit Curve and Valley Curve

Procedure of circular horizontal curve layout in the field:

1-Circular curve layout by deflection angles

2-Circular curve layout by coordinates

3- Circular curve layout by offsets: (i) tangent offsets, (ii) chord offsets, (iii) middle ordinates, (iv) ordinates from the long chord

3.2 **(10 points)**

$$Y = Y_{BVC} + g_1X + \left(\frac{r}{2}\right)X^2$$

r =(g2-g1)/L=-2-2/500=-0.008

Y_{BVC}=600 ft

Curve elevations for stations at every 50ft **as follows**