University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Surveying
Time : 3 Hours

Course Code: CE 105
Full Marks: 100

Answer ANY 5 out of 7 questions

1. (a) The TBM of a location in the site is 20.842 m AOD. A leveling job was conducted by tilting level in four locations. The readings were taken for different steps are (12)
Setup 1 :1.361,2.844,2.018,3.015, Setup 2: 0.8555, 0.611, 1.805
Setup 3 :2.741, 1.711, Setup 4: 2.855,1.362, 2.111, 0.856, 2.015
i) Determine the TBM at the last point of the location using Rise and Fall Method.
ii) Calculate the misclosure error and correct the reduced levels if the TBM of the final location is 20.1 m.

(b) How can you check if a point is within a polygon? Explain with example for both raster and vector maps. (4)

(c) Derive the formula for curvature and refraction error in leveling. (4)

2. (a) Draw the basic diagram of a circular curve and write the names of its basic elements. Also derive the relationships for R,L,T and LC.Draw the basic diagram of a spiral curve and identify its basic elements as well. (8)

(b) Assume that I = 8^0 24′ ,the station of PI is 64+27.46, and terrain conditions require the minimum radius permitted by the specifications of say, 2864.79 ft (arc definition). Calculate the PC and PT stationing and the external and middle ordinate distances for this curve. Also compute sub-deflection angles and sub-chords δ_a ,c_a , δ_b and c_b. Calculate the chord c. From that, present the results in tabular form of laying out the curve on the field using deflection angle method. (12)

3. (a) A base line was measured in catenary as shown below, with a tape of nominal length 30m.The tape measured 30.015 m when standardized in catenary at 20^0 C and 5 kgf tension. If the mean reduced level of the base was 30.50 m OD, calculate its true length at mean sea level. Given: weight per unit length of tape = 0.03 kg/m; density of steel = 7690 kg/ m^3, coefficient of expansion = 11x 10^{-6} per ^{0} C; E = 210 x 10^3 N/mm^2; gravitational acceleration g = 9.806 m/s^2; radius of the earth = 6.4 x 10^6 m. (13)

Bay	*Measured length (m)*	*Temperature (deg-C)*	*Applied tension (kgf)*	*Difference in level (m)*
1	30.050	21.6	5	0.750
2	30.064	21.6	5	0.345
3	30.095	24.0	5	1.420
4	30.047	24.0	5	0.400
5	30.041	24.0	7	-

(b) What are the sources of survey data? Explain with example how data can be stored with topological data structure. (2+5)

4. (a) Station A and B have elevations of 265.69 ft and 311.48 ft respectively. Their corresponding instrument heights are 5 ft and 5.5 ft. AB =133.47 ft. A = 40-35-11 (deg-min-sec), B = 31-28-29, v1= 7-14-21 and v2 = 4-8-12. What is the elevation of the chimney stack? (10)

(b) What are the uses of Aerial Photography? Write the specific features of Aerial Photography and satellite images. (3+3))

(c) What are the common structures of survey data? (4)

5. (a) Coordinates of the corner points of a polygon are A(8.34,591.78), B(517.44,202.94), C (523.41,11.27), D(716.29,694.02) and E(125.72, 847.71). Calculate the area of the polygon. (10)

(b) Explain mathematically how the position of an unknown ground point is obtained by GPS machines. (7)

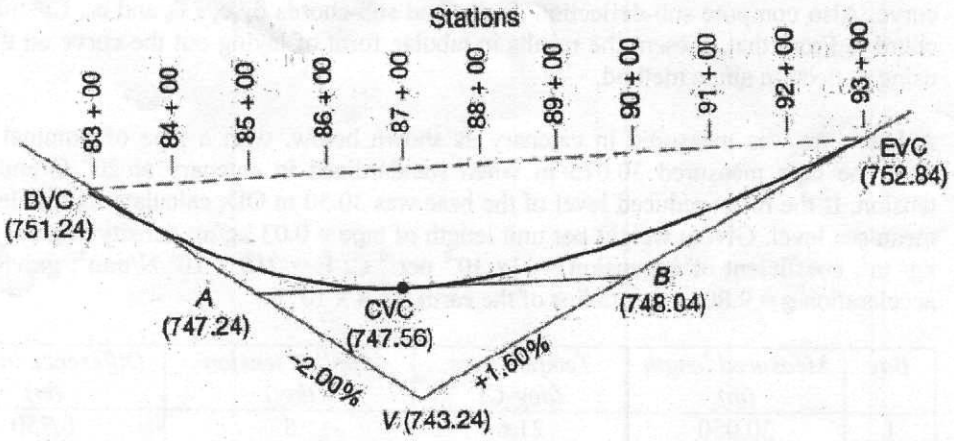
(c) What is GIS? (3)

6. (a) Compute the volume of excavation between station 25+00 with an end area of 711 ft^2 and stations 26+00 with an end area of 515 ft^2. (9)

(b) What is GPS? Briefly describe the different segments of GPS. (2+5)

(c) What are the different sources of error in traversing? (4)

7. (a) For the configuration of figure below, compute and tabulate the notes necessary to stake the unequal-tangent vertical curve at full stations. (15)



(b) Write a short note on Map Projection. (5)

Given formula:

1. $T = R\tan\frac{\Delta}{2}$, $l = \frac{\pi R\Delta}{180^\circ}$, $\delta = 1718.9\frac{c}{R}$
2. $O_1 = \frac{c^2}{2R}$, $O_2 = \frac{C}{2R}(c+C)$, $O_3 = ... = O_{n-1} = \frac{C^2}{R}$, $O_n = \frac{c'}{2R}(C+c')$
3. $L_{transition} = \frac{v^3}{\alpha R}$, $\Delta_s = 1719\frac{L}{R}$, $\Delta_c = \Delta - 2\Delta_s$, $L_{circular} = \frac{\pi R\Delta_c}{180^\circ}$, $s = \frac{L^2}{24R}$, $\tan\theta = \frac{v^2}{gR}$
4. $T = (R+s)\tan\Delta + \frac{L}{2}$
5. $s_h = \frac{f}{H-h}$, $L = (1-p_l)sl$, $W = (1-p_w)sw$
6. $a = L \times W$, $N = \frac{A}{a}$
7. $N_1 = \frac{L_1}{(1-p_l)sl} + 1$, $N_2 = \frac{L_2}{(1-p_w)sw} + 1$
8. $\tan\alpha_a = \frac{x_a}{f}$
9. $\tan\alpha_b = \frac{x_b}{f}$
10. Level Section $A = (b + nh)\, h$
11. Two-Level Section $A = \{n\,(b/2)^2 + m^2\,(b+nh)h\}/(m^2-n^2)$
12. Three-Level Section $A = \{b\,(h_1+h_2)/4 + h\,(w_1+w_2)/2\}$

    $w_i = m_i n/(m_i - n)\,(h + b/2n)$
    $h_1 = m_1 n/(m_1 - n)\,(h + b/2m_1)$
    $h_2 = m_2 n/(m_2 - n)\,(h - b/2m_2)$
13. $V = \frac{d}{6}(A_1 + A_2 + 4A_m)$

Note: Here the symbols have their usual meanings.

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(13)

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*There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". You have to answer from both sections according to the instruction mentioned in each section.*

SECTION A

There are **FOUR** questions in this section. Answer any **THREE.**

1. (a) What is Interpolation of contours? Discuss any method of Interpolation of contours. (2+7)
   (b) Define (i) Check Line (ii) Tie Line (iii) Main Station. (3)
   (c) An excavation is to be made for a reservoir 20 m long and 14 m wide at the bottom, having side of the excavation slope at 2 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 4 metres. The ground surface is level before excavation. (13)

2. (a) Explain how the procedure of reciprocal leveling eliminates the effects of atmospheric refraction and earth's curvature. (10)
   (b) A camera having focal length of 20 cm is used to take a vertical photograph to a terrain having an average elevation of 1500 m. What is the height above mean sea level at which an aircraft must fly in order to get the photograph at a scale of 1: 7500? (11)
   (c) Define (i) Bench Mark (ii) Datum (iii) Elevation (iv) Turning Point (4)

3. (a) What are the instruments used in chain surveying? (3)
   (b) What detailed instructions would you give to a fresh trainee surveyor regarding the care and use of his field book for recording survey measurements? (6)
   (c) The following consecutive readings were taken with a level (16)
   5.31, 5.92, 6.12, 8.42, 9.81, 6.64, 7.92, 10.21,9.22,7.32,8.45
   The level was shifted after 3rd, 6th and 9th readings. The reduced level at first point was 170 ft. Calculate the reduced levels of the points by using Height of Instrument Method and apply usual arithmetic check.

4. (a) Define (i) Terrestrial Photogrammetry (ii) Aerial Photogrammetry (4)
   (b) A street bend which deflects 70° is to be designed for a maximum speed of 150 km per hour, a maximum centrifugal ratio of 1/5 and a maximum change of acceleration of 35 cm/sec^3, the curve consisting of a circular arc combined with two transition curves. Calculate a) the radius of the circular arc b) length of transition curve c) total length of the composition curve d) the chainage of the beginning and the end of the transition curve and the junctions of the transition curves with the circular arc if the chainage of the P.I is 45000 metres (12)
   (c) Prove, $C = 6/7\ (D^2/2R)$, here the symbols have their usual meanings. (9)

SECTION B

There are **FOUR** questions in this section. Answer any **THREE.**

5. (a) Derive the relation between the radius and degree of curvature for a simple circular curve by using the arc definition and chord definition of curvature. (8)
   (b) Define (i) Compound curve (ii) Transition curve (2)
   (c) Two tangents intersect at chainage 85+75, the deflection angle being 68° 35′. Calculate the necessary data for setting out a curve of 40 chain radius to connect the two tangents, if it is intended to set out the curve by offset from chords. Consider peg interval equals to 100 links, length of the chain being equal to 20 m (100 links). (15)

6. (a) Define (i) Vertical Photograph (ii) Oblique Photograph (iii) Tilted Photograph (iv) Flying height (v) Flight Line. (10)
   (b) An aircraft has been planned to fly over a defined territory to prepare a map of that area. The territory covers an area of 12.5 km x 14.5 km. The scale of the photograph is 1 cm = 300 m. The photograph size is 18 cm x 18 cm. Determine the number of photographs to cover the area, if the desired overlap is 65% and the side lap is 30%. (15)

7. (a) Define (i) Celestial Poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. Draw necessary sketches. (10)
   (b) Find the distance between two places P and Q along the parallel of latitude, given that latitudes of P and Q are 29° 0′ N and their longitudes are 110° 0′ E and 131° 27′ W respectively. (15)

8. (a) What is GPS? Briefly describe different segments of GPS. (2+10)
   (b) Compute the traverse area by the coordinate method for the following points A(523.41,0), B(716.29,694.02),C(125.72,847.71), D(0,591.78), E(517.44,202.94) (13)

Given formula:

1. $T = R\tan\frac{\Delta}{2}$, $l = \frac{\pi R\Delta}{180^\circ}$, $\delta = 1718.9\frac{c}{R}$
2. $O_1 = \frac{c^2}{2R}$, $O_2 = \frac{C}{2R}(c+C)$, $O_3 = ... = O_{n-1} = \frac{C^2}{R}$, $O_n = \frac{c'}{2R}(C+c')$
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13. $V = \frac{d}{6}(A_1 + A_2 + 4A_m)$

Note: Here the symbols have their usual meanings.