The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Civil Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: CVX 5440/CVX5530 Engineering surveying II**
Academic Year	: 2020/2021
Date	: 20th January 2022
Time	: 0930-1230hrs
Duration	: **03 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **SEVEN (07)** questions on **SEVEN (07)** pages.
3. Answer **FIVE (05)** questions out of **SEVEN (07)** questions
4. Answer for each question should commence from a new page.
5. Necessary additional information is provided.
6. This is a Closed Book Test (CBT).
7. Answers should be in clear hand writing.
8. Do not use Red colour pen.

Question 1

1.1)
Explain the difference between end area method and Prismoidal formula method for volume calculations (6 Marks)

1.2) The center line of an embankment is on a curve of radius 150 m, where the original ground surface being approximately level. The formation width is to be increased from 6 to 8 m by widening the embankment, The filling to occur entirely on the outside of the curve, and also retaining the existing side slope of 1 vertical to 2 horizontal. If the height of formation increases uniformly from 2.20 to 4.60 m over a length of 90 m, Find the volume of earthwork involved in this length by using Prismoidal formula.

(14 Marks)

Question 2

2.1)
Figure 1 shows two photographs taken at point A for stereoscopic viewing.

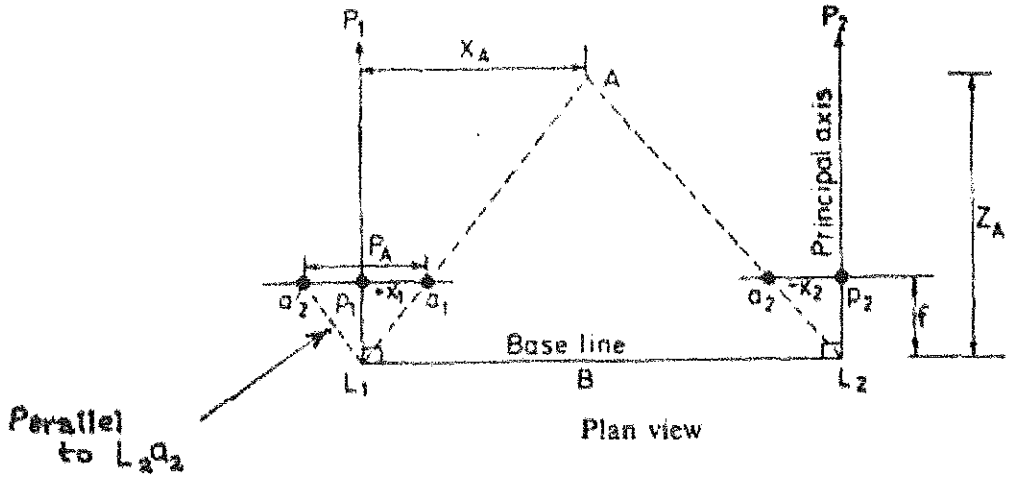

Figure 1

Considering the y axis in the direction into the paper, derive standard expressions for X_A, Y_A and Z_A. (4 Marks)

2.2)
Figure 2 shows a photograph taken by a photo theodolite at points A and B. The X and Y coordinates of each point is shown in the figure 2.2. If the instruments is 0at point C, determine the vertical angle between point A and B if the focal length is 165 mm. (8 Marks)

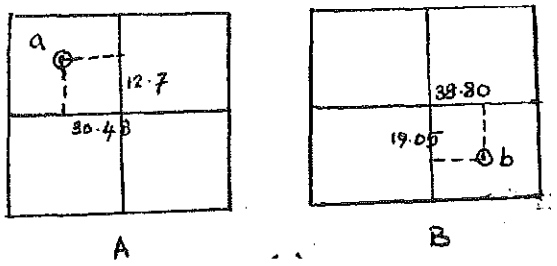

Figure 2

2.3)
If the actual horizontal distances to the points A and B from instruments station C are 80m and 60m respectively, and MSL at point B is 25 m, determine the MSL at point A. (8 Marks)

Question 3

3.1)
Briefly explain the significance of "rate of change of gradient" in vertical curve designs
(2 Marks)

3.2)
Figure 3 shows a parabolic vertical curve between point A and point B. Prove that the offset of tangent y' is $[(g_1+g_2)/200L]x^2$. (8 Marks)

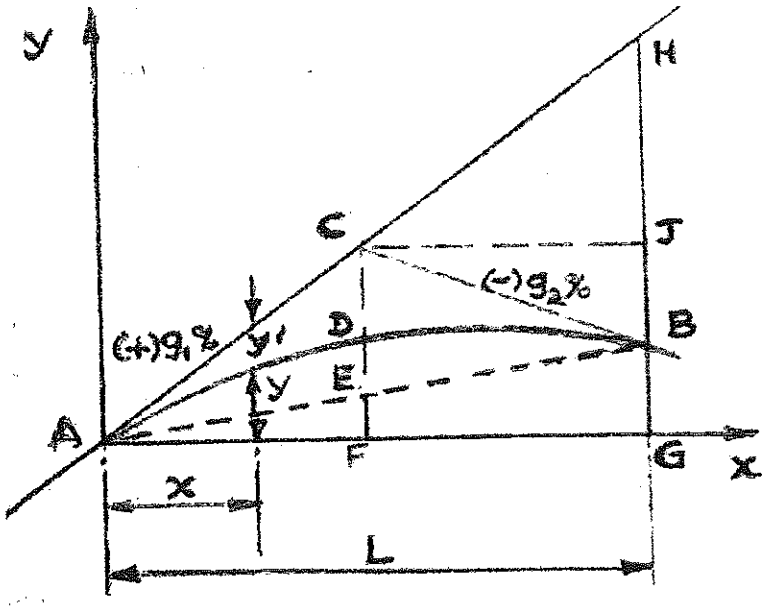

Figure 3

3.3)
Two points of a road is connected with a sag curve with a grade angle -3% and mid offset of 0.8 m. If the falling gradient is two times the rising gradient determine the falling and rising gradients, and the length of the curve. (10 Marks)

Question 4

4.1)
Briefly explain occasions where method of two wires in a single Shaft is used in tunnel surveying.
(2 Marks)

4.2)
Briefly explain Weisbach triangles with establishing conditions and the application of Weisbach triangles to determine the bearings of underground reference lines
(4 Marks)

4.3)
Figure 4 shows the utilization of two wires in one shaft to perform underground surveying. The angles <QPB, <QPA, <VUB and < VUA and distances PA, AB and BU are measured. Using these measurement please derive and expression to determine the bearing of the underground reference line UV.
(14 Marks)

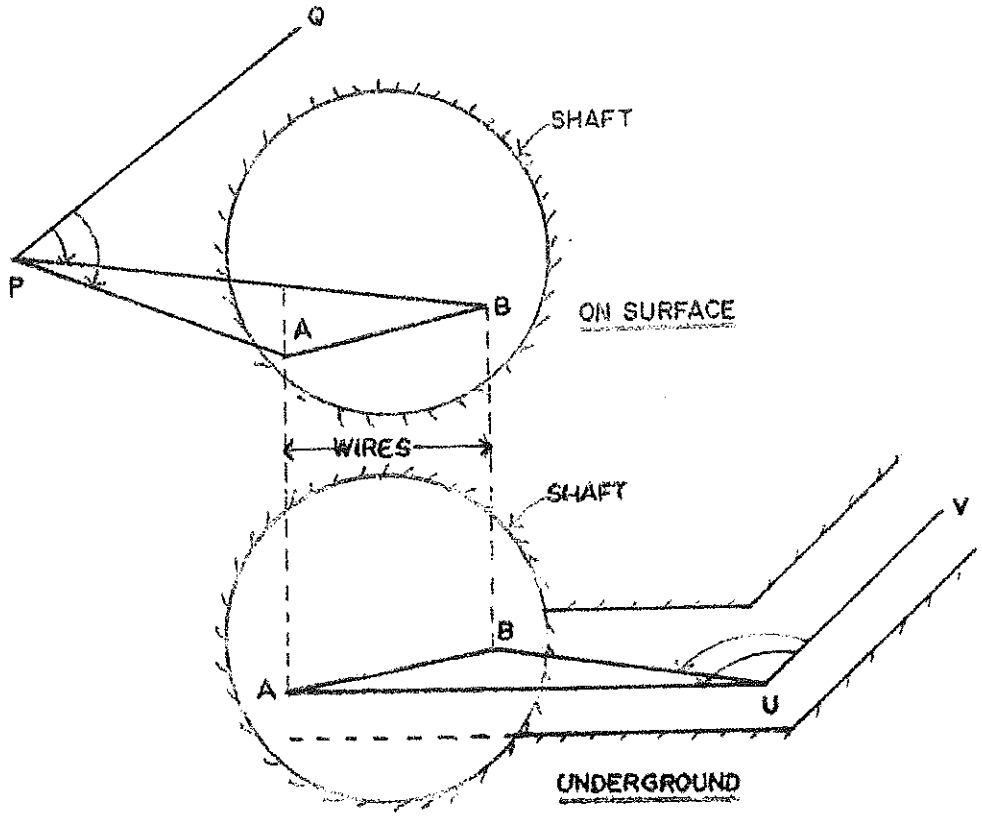

Figure 4

Question 5

5.1)
The following readings were taken in an angle measurement. Calculate the mean of the observed angle after rejecting abnormal values. $47^0$16'32.25", $47^0$16'48.37", $47^0$16'27.77", $47^0$16'34.52", $47^0$16'29.32", $47^0$16'36.78", $47^0$16'37.43" (Hint: Standard deviation $\sigma = \sqrt{(\sum(x_i - \mu)^2 / N)}$, x_i= each value from population, μ= population mean value, N= size of the population)

(8 Marks)

5.2)
The Figure 5 shows a turning circle established at a car park. The triangle ABC is supposed t be a reservation for a monument. The observations for the angles **a**, **b** were measured two times each and the average readings were 40^0 00'10", $49^0$59'59" respectively. Determine the most probable values for angles **a** and **b**. (12 Marks)

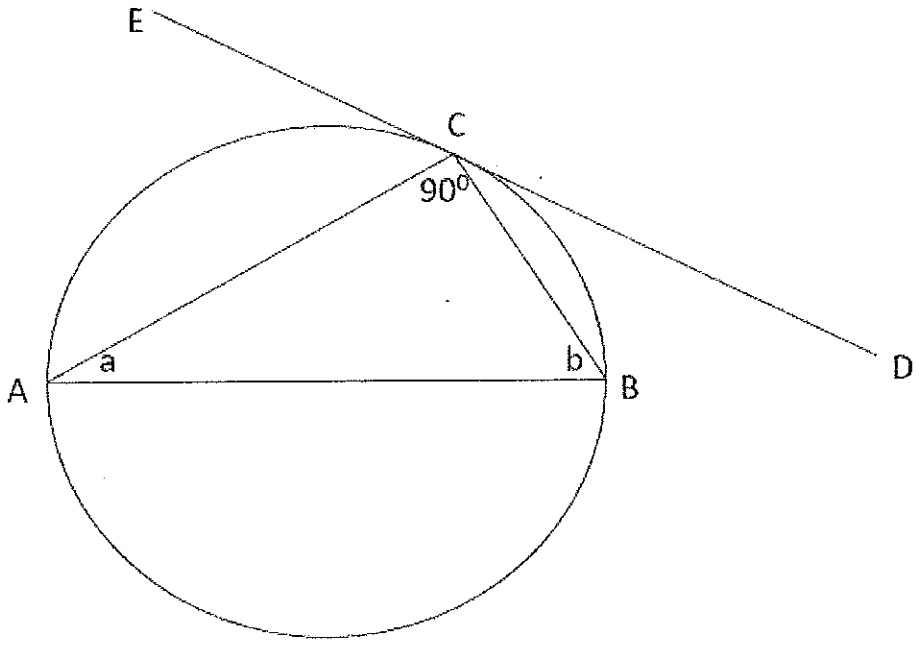

Figure 5

Question 6

6.1)
The adjustment of triangles are generally performed by using geometric conditions. Please explain generally used geometric conditions in adjusting triangulation networks. (6 Marks)

6.2)
The Figure 6 shows a part of a triangulation network. Please derive all the conditional equations clearly stating sequence. (14 Marks)

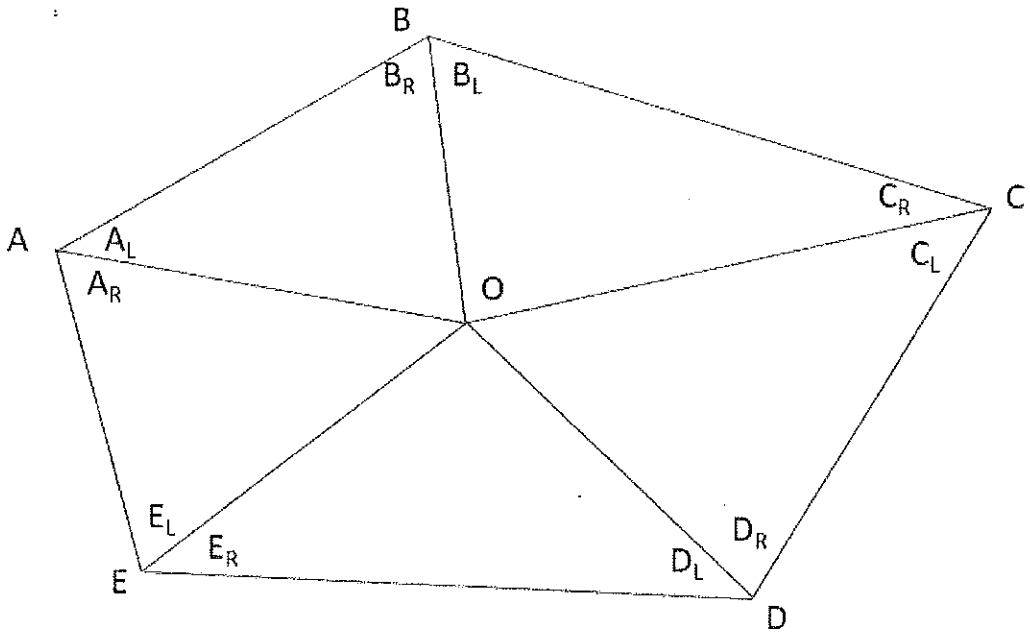

Figure 6

Question 7

7.1)
In aerial photography, various definitions and terms are used to describe geographical orientations. Draw a schematic diagram and indicate Optical axis, Focal length, Photo axes, Vertical axis, Tilt, Principal point, Plumb point, ISO center and Principal line on the diagram.

(8 Marks)

7.2)

Aerial photographs are generally taken with the axis of the camera pointing vertically downwards. However, due to the tilt and roll of the aircraft a truly vertical photograph is rarely taken. Using following schematic Figure 7 and standard notations, show that the scale of a random point is given by $S = [f \pm y \sin \theta] / H$

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(12 Marks)

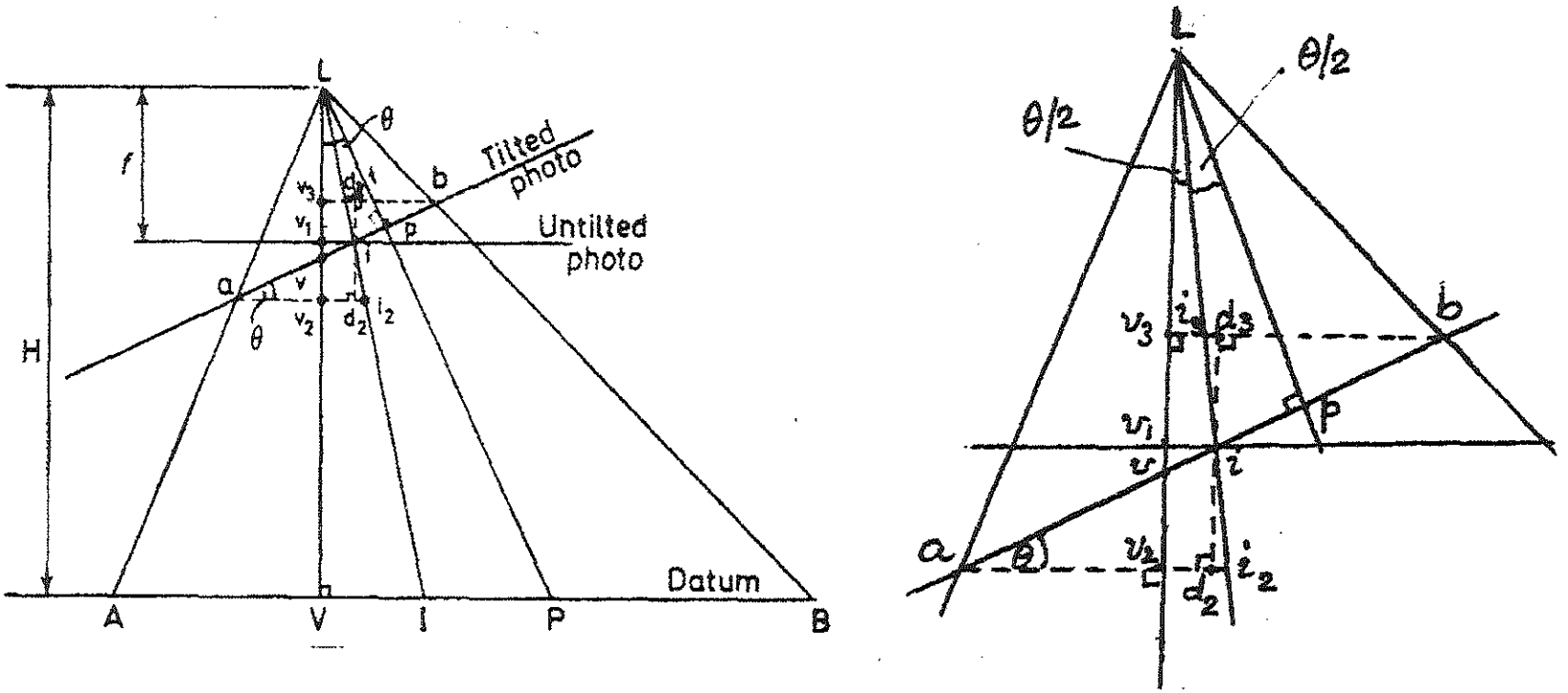

Figure 7