

**King Saud University**  
**College of Engineering**  
**Civil Engineering Department**  
**Introduction to Geomatic Engineering**  
**SE 311**

Midterm Test

Answer all questions

Time: 1 hour

**Question One**

Write down the parts of the optical theodolite as indicated by the appropriate numbers on the attached diagram:

- 1-                                  2-                                  3-                                  4-  
 5-

According to scale reading design optical theodolites can mainly be classified as:

- 1-                                  2-                                  3-

**Question Two**

According to wavelengths and range measurement Electromagnetic Distance Measuring devices can be divided into:

- 1-                                  2-                                  3-

An EDM was used to measure a slant distance between two traverse stations. The refractive index of the atmosphere was determined as 1.00028 during observation period. The two-way travel time of the optical pulse was  $2.8 \times 10^{-3}$  ms. The signal speed in vacuum is 299792.48 km/sec. Compute the observed distance to the nearest cm.

Speed of signal in the atmosphere =

Observed distance between traverse stations =

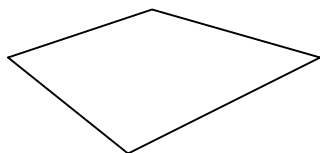
**Question Three**

State down three ground survey methods for control extension:

- 1-                                  2-                                  3-

Write down the type of traverse:

(where      is a control point,      is a traverse point to be fixed)



1-



2-

In traverse 2 above, the azimuth of AB is  $65^\circ$ , the horizontal angle measured at B is  $210^\circ$  ; the azimuth of CB will be = .....

Hydrographic Surveying SE 417

Tutorial No. 3

Question One

Compute the diameter of a circular transducer to produce a conical beamwidth of  $30^\circ$  with acoustic transmission of 100 KHz and  $1500\text{ms}^{-1}$  speed in water.  
If a rectangular transducer of dimensions 1.2m x 0.2m is used to produce the same wave frequency, compute the produced beamwidth in degrees.

Question Two

The acoustic velocity through a specific water body is given by the following formula:

$$v = 1449.10 + 4.565 t - 0.0517 t^2 + 1.338(S-35) - 0.013 t (S-35) \text{ ms}^{-1}$$

The observed temp and salinity are respectively given as:

$10 \pm 1^\circ\text{C}$  and  $37 \pm 1\text{ppt}$ .

Compute the acoustic velocity and its standard error.

Question Three

An echosounder was set in a vessel 3.0m below the water level. The two-way travel time of the signal between the system and the water bed was observed as  $200 \pm 5 \text{ ms}$ . The acoustic speed in water is given as  $1500\text{ms}^{-1}$

Compute the observed sounding.

The Lowest Water Level (Tidal Datum) recorded by a tidal gauge at a nearby port is 4.0m, and the water level recorded at the observation time is 5.1m. Compute the reduced sounding.

Engineering Surveying SE 310

Question One

Determine the approximate distance at which correction for curvature and refraction in leveling amounts to 3mm, assuming that the effect of refraction is one seventh that of Earth's curvature and that the Earth is a sphere of 12740 km diameter.

Question Two

Two survey stations A and B on opposite sides of a river are 780m apart, and reciprocal levels have been taken between them with the following results:

Inst. At	height of ins. (m)	staff at	staff reading (m)
A	1.472	B	1.835
B	1.496	A	1.213

Compute the ratio of refraction correction to curvature correction, and the difference in level between A and B.

Question Three

Observations were made between points P and Q on opposite sides of a wide water body as follows:

Level at P, inst ht. = 1.380m, staff reading at Q = 1.755m

Level at Q, inst ht. = 1.450m, staff reading at P = 1.455m

Calculate the difference in level between the two stations and the reduced level of P if Q is 620.00m above datum.

## Tutorial No. 11

In a rho/rho radio positioning system, the shore control points G and R and the synch. Station O have the following coordinates:

Station	e(km)	n(km)
G	10 000	10 000
R	10 200	10 300
O	10 100	10 180

The approximate ship coordinates at the moment of observing phase differences of received signals

are: (10 399 , 10 200)km.

Wavelengths of pulses transmitted from G and R stations are respectively, 0.174248k and 0.176091km. The phase differences observed onboard the ship for the two pulses are respectively 8701 rad and 2405 rad.

Calculate the ship coordinates at the moment of observation.

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15/3/1426

Engineering Surveying SE 310

Midterm Test

**Question One**

Figure 1 shows a side hill section where the ground slope gradient is 1:5, given the following information, calculate the area of cutting and area of filling:  
 Formation width  $b = 15\text{m}$ , central height,  $c = 0.5\text{m}$ .

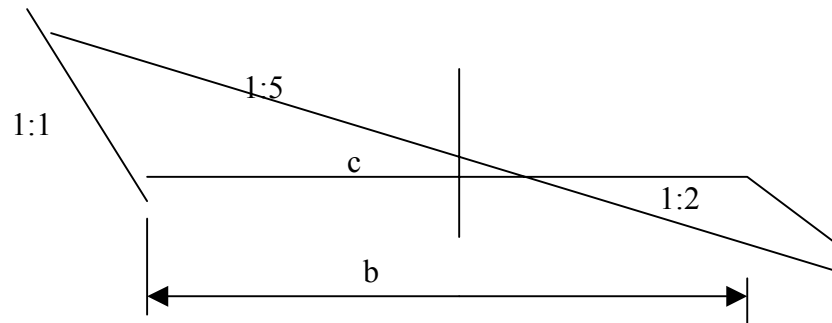


Figure 1

**Question Two**

Volumes of cut (+ve) and fill (-ve) along a length of a proposed road are as follows:

Chainage (m)	0	100	200	300	400	500
Volume ( $\text{m}^3$ )	+300	+750	+1700	+600	+100	

Chainage (m)	500	600	700	800	900	1000
Volume ( $\text{m}^3$ )	-100	-350	-1600	-800	-700	

Draw a MHD.

What is the surplus excavated material?

If the freehaul distance is 300m, determine the overhaul.

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## Hydrographic Surveying

SE 417

### Tutorial No. 12

The Keplerian elements of a navigational satellite are given as:

Major axis = 27600km, orbital eccentricity = 0.001

Argument of Perigee =  $45^\circ$ , Right Ascension =  $30^\circ$ , Inclination =  $60^\circ$

Time of passing Perigee =  $0^h$  GAST

$$u = 3.986008 \times 10^{14} \text{ m}^3/\text{sec}^2$$

Determine:

- 1) the orbital period of the satellite
- 2) the orbital coordinates of the satellite at time  $3^h$  GAST
- 3) the geocentric inertial coordinates of the satellite at  $3^h$  GAST
- 4) the conventional terrestrial coordinates of the satellite at time  $3^h$  GAST
- 5) the range between the satellite and a ship whose coordinates are given as: (2000.0 , 7000.0 , 2000.0)km in the conventional system at time  $3^h$  GAST

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**Engineering Surveying SE 310  
Midterm Exam**

**Question One**

Stations P,Q and A form a right-angled triangle at station P (fig. 1). A tacheometer whose constants are 100 and 0 was used to determine the following data:

Inst. Station: P, Height of Inst = 1.410m, Reduced Level of P= 629.600m

Target stn	vertical angle	Stadia readings (m)		
Q	-5° 40'	1.830	1.500	1.170
A	+2° 30'	2.810	2.610	2.410

Calculate: a) horizontal lengths PQ and PA, b) reduced levels of Q and A

**Question Two**

A roadway is to be built on ground having a transverse ground slope of 1 in 8. The road is 8.0m wide, has a central height of 3.5m, and 1:4 side slopes (fig. 2).

Calculate the crosssectional area of the embankment.

**Question Three**

The center line of a tunnel is represented by two plumb lines , C and D, 4 meters apart, hanging vertically in a shaft, the whole circle bearing of the line CD being 80°. A theodolite is set up underground at a point A, distance 3.900m and roughly east of the nearer plumb line D, and the observed value of the angle CAD is found to be 15'(fig. 3). Calculate the bearing of the line CA, and the perpendicular distance from A to the center line of the tunnel.

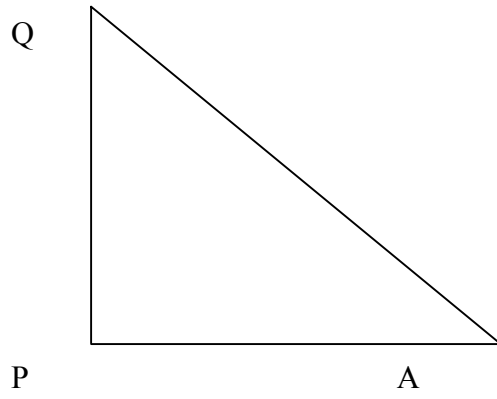


Fig. 1

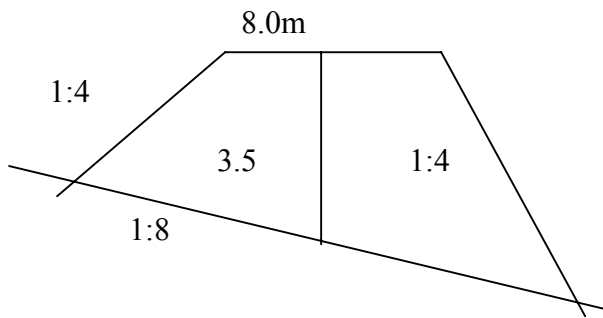


Fig. 2

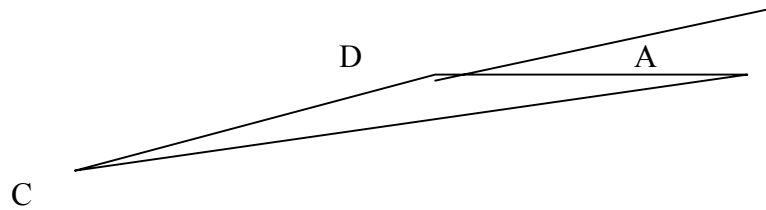


Fig. 3



**King Saud University**

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**Civil Engineering Department**

**Mid-term Exam**

**Answer all questions**

**Time: 50 minutes**

**Question One**

Explain briefly how each of the following can be used to measure water depths.

a- overlapping aerial photographs

b- airborne LIDAR

**Question Two**

The acoustic speed in sea water is given as:

$$v = 1410.00 + 4.21 t - 0.37 t^2 + 1.14 S + 0.018 d \quad \text{m/s.}$$

The observations of water depth, temperature and salinity are given respectively as:  $80 \pm 2\text{m}$ ,  $20 \pm 1^\circ\text{C}$ ,  $35 \pm 1 \text{ppt}$ .

Compute the signal speed in water and its accuracy.

**Question Three**

A ship was observed from two shore stations: A(1100.0, 500.0)m and B(1600.0, 400.0)m. The ship is north of the shore line, as shown in figure 1.

The observed horizontal angles are:  $\alpha = 82^\circ 15' 00''$  and  $\beta = 44^\circ 05' 00''$

Compute the coordinates of the ship.

