



FACULTY OF ENGINEERING AND ENVIRONMENT
DEPARTMENT OF SURVEYING AND GEOMATICS
Hydrographic Surveying
EGS 3202
Final Examination Paper

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Miss B. Mwabvu

INSTRUCTIONS

1. Answer all 4 questions
2. Each question carries 25 marks
3. Use of calculators is permissible, but programmable calculators are not allowed in the exam

Additional Requirements

If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer, a clear statement of any assumptions made.

MARK ALLOCATION

Question 1 to 4	25Marks
Part Questions	As shown in each part question
Total Attainable	100

Question 1 [25 Marks]		
1a)	<p>i) Define the following terms</p> <p>(a) Hydrographic chart</p> <p>(b) Sounding</p> <p>(c) Sounding line</p> <p>(d) Range lines</p> <p>(e) Gaging station</p> <p>(f) Stream gaging</p>	[12]
b)	<p>i) Briefly describe two major sources of uncertainty that contribute to a sounding's Total vertical uncertainty</p> <p>ii) Describe the main factors that contribute to the attenuation of an acoustic signal in water?</p> <p>iii) Describe the propagation of sound from a point source through water. How does it interact with seabed?</p>	<p>[2]</p> <p>[3]</p> <p>[3]</p>
c)	<p>(i) It is good survey practice to use instruments which meet minimum standards for the survey task at hand. Instrument calibration is one way of achieving this. Explain one method of calibrating an echo-sounder.</p> <p>(ii) After cleaning and processing your multibeam data, you detected a short period undulation of the data producing across track ribbing in the sun-illuminated image. Explain what the cause of the error might be.</p>	<p>[3]</p> <p>[2]</p>

Question 2 (25marks)		[12]
<p>2(a) Hydrographic Survey can be Classified into four that is Topographic survey, Outline Survey, Surveys of submerged areas and Measurement of Stream Flow</p> <p>Write notes on each of the classification.</p>		
<p>(b) Hydrography relies on a variety of scientific and engineering disciplines. Outline four disciplines giving their relevance to hydrographic surveys.</p>		[12]
<p>(c) Briefly explain the term Geomatics</p>		[3]

Question 2 [25 Marks]		
B2a)	(i) Define a triangulation system	[1]
	(ii) State and briefly describe the stages encountered during fixing control by triangulation in hydrographic surveying	[5]
	iii) What does the strength of figure in a triangulation network depend on? iv) Why is it necessary to determine the strength of figure in hydrographic survey work	[4]
d)	Define geopotential number. What does it express physically?	[2]
e)	(i) Ellipsoid referenced surveys are becoming more common as techniques and technology become refined. The major hurdle is the transformation between the ellipsoid and a datum that is used for nautical products. Discuss how you would transform between the ellipsoid and a tidal based chart datum (i.e. Lower Low Water Large Tide)? Assume the area is small enough that the transformation is uniform throughout the whole area. (ii) Briefly describe 2 major advantages of this technique over traditional Water Level Gauging	[5] [2]
f)	i) The survey profession has widely embraced Unmanned Aerial Vehicles (UAVs), and Hydrographic Surveying has not been spared in this technological race. Outline some of the advantages of using UAVs technology in hydrographic surveying. i) Outline at least three height determination systems used in hydrographic surveying.	[3] [3]

Question 3 [25 Marks]		
B3a)	<p>You are to conduct a post dredging survey in the mouth of a river with multi-beam sonar where the bottom type is very fine silt. There are water level gauges located a few kilometres on either side of the work site, and the sound speed structure in the area is very dynamic.</p> <p>i) Discuss your pre-survey calibration procedures, for example how would you confirm and document that your sonar is measuring what it should be measuring and that its integration with ancillary systems are accurate?</p> <p>ii) What techniques and collection strategies would you employ to minimize the major sources of random errors during the survey?</p> <p>iii) You discover the survey area, when dredged, creates a layer of fluid mud right above the bottom. Your initial survey was conducted with multi-beam sonar at 300kHz. You suspect that with this high frequency, you may have been detecting this layer of mud. What strategies would you employ to ensure you are getting 'real' bottom? (Assume you have access to other types of equipment)</p>	<p>[6]</p> <p>[3]</p> <p>[5]</p>
b)	List at least 4 good survey procedures you deem important in ensuring high accuracy standards in carrying out hydrographic surveys for horizontal control.	[4]
c)	List at least four considerations in estimating total propagated depth error in multi-beam echo sounding (MBES)	[4]
d)	<p>Explain the meaning of the following in error propagation in hydrographic surveying</p> <p>(i) Circle of Equal Probability</p> <p>(ii) Distance Root Mean Square Error (DRMS)</p>	[3]

Question 4 [25 Marks]		
B4a)	Discuss the advantages of combined networks for establishing horizontal control in surveys to determine the outline of a large body of water such as a large river, citing examples of possible networks that can be combined in these hydrographic surveys	[6]
b)	A hydrographic surveyor wishes to determine the outline of a large meandering river. A slope distance of 6704.511 m is observed between two stations 1 and 2 across the water body and exactly at the shores of the water body whose geodetic heights are 916.963 and 928.578 m respectively. The height of the instrument at the time of the observation was 1.500 m and the height of the reflector was 1.825 m. The latitude of Station 1 is $33^{\circ}08'36.2947''$, and the bearing 1-2 is $202^{\circ}28'21.9''$. What are the geodetic and mark-to-mark distances for this observation?	[7]
c)	Distinguish between time delay and phase delay Beam foaming	[2]
d)	Compare and contrast the advantages and disadvantages of using bathymetric Lidar versus multi beam echo sounders?	[3]
e)	<p>i) Describe with the aid of a diagram what factors affect the size of a beam footprint</p> <p>ii) What three parameters should be measured to determine the speed of sound in water?</p> <p>iii) Choose one of the parameters and state what would happen to the sound speed if it were increased</p>	<p>[3]</p> <p>[3]</p> <p>[1]</p>

END OF EXAMINATION