1.C Advanced Surveying

RATING (R) SCALE:
0. Have no experience/knowledge with this
1. Have observed this or been oriented to this
2. Can participate in and assist with this
3. Can do this with minimum assistance
4. Can successfully do this without assistance
5. Can successfully do this without assistance and lead

Competency	What Constitutes Competency Attainment	R	Documentation or Other Evidence for Proof	R	Assessor Comments
1) Discuss the concept of precision as it relates to surveying processes	Knowledge of the sources and types of random errors and their quantification.		Taken GGE3022, University of New Brunswick (UNB), 2017; mark 79% See transcript and course description.	5	
2) Discuss the concept of accuracy as it relates to surveying processes	Knowledge of the sources and types of systematic errors and how to deal with them.		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	
3) Required procedures and quality assurance measures	Knowledge for: • the testing and calibration of surveying instruments; • measurements of high precision; • underground surveying; • non-astronomic observations for azimuth.		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	

	Able to assess the results of any of the above.				
4) Design the appropriate combination of equipment and procedures for a data gathering task	Able to carry this out so the gathered data meets the quality requirements of relative positioning (horizontally or vertically or in three dimensions simultaneously).		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	
5) With respect to specifications for equipment and procedures	Translate specifications and equipment, such as maximum allowable misclosures [angular or linear], into a choice of equipment and procedures for horizontal or height or three-dimensional traversing.		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	
6) With respect to specifications and procedures	Ability to compose specifications and requirements [standards and quality assurance procedures] for gathering survey related data.		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	
7) With respect to survey processes	Able to differentiate between the processes that result in position information and the processes that require repeated positioning for local deformation monitoring.		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	
8) With respect to long-term monitoring	Able to discuss the implication of repeated measurements for long-term monitoring with		Taken GGE3022, UNB, 2017; mark 79% See transcript and course description.	5	

	respect to systematic and random influences on the measurement systems				

1.E Geospatial Information Systems

RATING SCALE:
0. Have no experience/knowledge with this
1. Have observed this or been oriented to this
2. Can participate in and assist with this
3. Can do this with minimum assistance
4. Can successfully do this without assistance
5. Can successfully do this without assistance and lead

Competency	What Constitutes Competency Attainment	R	Documentation or Other Evidence for Proof	R	Assessor Comments
1) Describe the concepts, principles, techniques and applications that are fundamental to GIS and that differentiate GIS and geographic science from other information systems, technologies and sciences.	• Define GIS terms as shown in the Glossary of GIS Terms in the appendix section of the essential reference. • Explain the basic concepts and principles associated with geospatial information management and systems, including how they differ from other information systems, and why. • Describe the functional basis of a GIS, including its classical three-tier architecture, • major system components, typical software components		Taken courses GGE3423 and GGE 4423, University of New Brunswick (UNB), 2017; mark of 85% and 88%. See transcript and courses descriptions.	5	

	(functions), and how it works. • Explain how the real-world is represented based on a feature model (i.e., point, line and area) in GIS. • Illustrate the range and diversity of GIS applications for solving real-world problems. • Describe the map projections and geo-referencing methods adopted in Canada and their importance to GIS. • Use common GIS techniques for spatial query, analysis, modeling, and related scientific computing.				
2) Explain the nature and characteristics of geospatial data, data representations, methods of data input and editing, and data organization and/or management in GIS.	• Explain the main characteristics (spatial and thematic) of geospatial data. • Differentiate the vector and raster methods of geospatial data representation. • Explain how topological data is created and handled in GIS by recalling the concept of topology and topological data structures in relation to geospatial data. • Illustrate how commonly-used data editing methods		Taken courses GGE3423 and GGE 4423, UNB, 2017; mark of 85% and 88%. See transcript and courses descriptions.	5	

	(such as generalization, edge matching, rubber sheeting, and address geocoding) work. • Describe characteristics of DEM and TIN model. • Explain the concept of database, database management system, and how databases are linked to GIS following either relational database model or object-relational database model. • Outline GIS data modeling process by identifying and explaining the different levels of data abstraction (conceptual, logical and physical), data models and their features.				
3) Apply GIS concepts, principles and techniques to real-world spatial problem solving and mapping applications.	• Differentiate between data, information and knowledge. • Discuss the difference between spatial information retrieval and analysis. • Compare vector and raster data in terms of data storage, analysis and representation. • Explain common data query and analysis operations available in a typical GIS.		Taken courses GGE3423 and GGE 4423, UNB, 2017; mark of 85% and 88%. See transcript and courses descriptions.	5	

	• Perform attribute-based and location-based (spatial) queries. • Perform spatial analysis using vector-based and raster-based buffering and overlay operations, and basic network analysis. • Categorize different spatial interpolation methods in terms of local vs. global and exact vs. inexact. • Discuss the characteristics of thematic maps (e.g., choropleth maps, dot map and graduate symbol maps) and general reference maps (e.g., topographic maps). • Explain the characteristics of measurement scales and their relationships to visual variables. • Apply basic cartographic principles, visual variables, and map symbology in map design and visualization in GIS. • Create process models for spatial (analytical) modeling under a set of constraints. • Demonstrate with examples how GIS analysis and				

	modeling skills can be used to solve spatial problems				
4) Evaluate different GIS data collection approaches and data sources that require the knowledge of data quality, data fusion, data exchange, metadata management, and other issues such as data pricing, data access policies, privacy, security, and organizational influences.	• Describe the main sources of geospatial data and different GIS data acquisition • methods, including digital terrain data. • Describe the types and sources of errors present in geospatial data. • Explain the main data quality indicators as included in most spatial data quality standards. • Outline the key data quality issues involved in using GIS. • Discuss the importance, possible usage, and components of spatial metadata as related to geospatial information management and GIS. • Explain briefly various types of standards related to geospatial information management and GIS. • Discuss why various data standards are important to GIS. • Use diagrams to explain how data interchange format works and the benefits of		Taken courses GGE3423, GGE 4423 and GGE 4313, UNB, 2017; mark of 85%, 88% and 78%. See transcript and courses descriptions.	5	

	using a data interchange format.				
5) Design appropriate implementation procedures and GIS development strategies that follow the general principles of business modeling, software engineering, and project management.	• Discuss the issues of implementing GIS with special reference to: data, people, technology and application. • Explain user requirements and how the user requirements may be acquired, defined and formally specified using a CASE tool or modeling language. • Recall the principles and methods of software engineering as applied to the development of GIS applications. • Contrast the benefits and shortcomings of using GIS in a specific application context. • Evaluate strategies, plans and procedures for implementing an effective GIS system. • Be aware of related organizational aspects (e.g., human resources, budget).		Taken courses GGE3423 and GGE 4423, UNB, 2017; mark of 85% and 88%. See transcript and courses descriptions.	5	

6) Outline the new developments on web-based mapping services and GIS for better geospatial information dissemination, decision support and applications.	• Describe the concepts of web GIS/mapping and web mapping services. • Describe different types of web mapping, including how their end users interact with client and server programs and their advantages and disadvantages. • Give examples of existing commercial web GIS/mapping software and online mapping services provided by the mainstream IT firms. • Compare between traditional GIS and web-based GIS and mapping services. • Identify some technical, organizational and social issues related to the development of web GIS/mapping and services. • Demonstrate the basic understanding of the implications of these new developments in geospatial information dissemination, decision support and applications.		Taken courses GGE3423 and GGE 4423, UNB, 2017; mark of 85% and 88%. See transcript and courses descriptions.	5	

1.F Geodetic Positioning

RATING (R) SCALE:
0. Have no experience/knowledge with this
1. Have observed this or been oriented to this
2. Can participate in and assist with this
3. Can do this with minimum assistance
4. Can successfully do this without assistance
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Competency	What Constitutes Competency Attainment	R	Documentation or Other Evidence for Proof	R	Assessor Comments
1) Physical aspects of geodetic positioning	• Explain the basics of the physical concept of the Earth's gravity field and how it affects coordinate systems and observations. • Define the deflections of the vertical and evaluate their effects on positioning. • Define the concept of geopotential numbers and explain how geopotential numbers are obtained.		Taken course SU1321, Plane surveying II; SU2570, GPS & Remote referencing; and SU3300, Geodesy and map projections; SU2320, Geodetic surveying at College of North Atlantic; marks of 75%, 78%, 82% and 80%. See transcript and course descriptions.	5	
2) Space reference systems	• Explain the establishment of a classical horizontal datum, a classical vertical datum. • Explain how modern 3D datums are established nowadays.		Taken course SU1321, Plane surveying II; SU2570, GPS & Remote referencing; and SU3300, Geodesy and map projections; SU2320, Geodetic surveying at College of North Atlantic; marks of 75%, 78%, 82% and 80%.	5	

	• Explain when and why there has been the evolution of datums in Canada: NAD27 – NAD83 – NAD83(CSRS) and the transformation between these datums. • Explain the relationship between NAD83(CSRS) and the different ITRFs and the transformation between these different 3D coordinate systems. • Explain the effect of plate tectonic on coordinates and their impact on the definition of coordinate systems and on transformations. • Explain the underlying principle of the upcoming new Canadian vertical datum and the differences compared to the existing one.		See transcript and course descriptions.		
3) Computation of coordinates	• Identify and select the appropriate coordinate system (either on a 3D space, on the ellipsoid or on the mapping plane) to be used in the		Taken course SU1321, Plane surveying II; SU2570, GPS & Remote referencing; and SU3300, Geodesy and map projections; SU2320, Geodetic surveying at College of North Atlantic; marks of 75%, 78%, 82% and 80%.	5	

	support of a specific geodetic application. • Reduce terrestrial observations (angular and distance measurements) collected on the Earth surface of the Earth relating them to the coordinate system chosen. • Perform coordinate transformation between the above-mentioned coordinate systems.		See transcript and course descriptions.		
4) Time scales and astronomy	• Define the difference time scales their realisation and relationships. • Explain the basic principles of the determination of astronomical latitude and longitude • Explain the basic principles of determination of astronomical azimuth. • Make observations, and determine values from them, on Polaris at any time for latitude or for azimuth, on Polaris at the optimal time for latitude or for		Taken course SU1321, Plane surveying II; SU2570, GPS & Remote referencing; and SU3300, Geodesy and map projections; SU2320, Geodetic surveying at College of North Atlantic; marks of 75%, 78%, 82% and 80%. See transcript and course descriptions.	5	

	azimuth, on the Sun for latitude or azimuth.				
5) GPS and other GNSS	• Explain the complications of electromagnetic wave propagation in the conditions of ranging from an extra-terrestrial source to the surface of the Earth. • Explain the concepts and the constituents of a GNSS, • Explain the signal structure of GPS. • Define the different types of GPS observations, pseudo-range, and phase observables, their characteristics and the associated mathematical model. • Explain the different positioning modes (absolute, differential, RTK, PPP), and compare them in terms of observation methods, mathematical models, measuring procedure, receiver type, and achievable accuracy. • Explain the error sources and achievable accuracy		As Project manager designed and carried out numerous GNSS projects while working for ABC Surveys Ltd. Projects included: • Control survey for gold mine M.M.G. Inc., 2018, using RTK method. • Establish survey network for City of MCR, 2018, using static method. • Powerline survey for Manitoba Power, 2018, using differential GPS Supervisor Joe Surveyor, CLS. Contact details jsurveyor@gmail.com; 306-444-2324. Taken Trimble training on GNSS introduction and on DGPS correction, 2017. Certificates of achievement attached.	5	

	associated with each positioning mode. • Design a GPS survey for a given application. • Comment on recent developments (modernization of GPS and GLONASS, Galileo).				