Draft GISc B Hon/ BSc/Professional Degree Framework

Level NQF 8. Minimum 480 credits

The workforce and competency requirements of a GISc technicians is defined in terms of the Geomatics Act 19 of 2013, section 2(a). This implies an understanding of sub-sections 2(a)(i), (ii), (iii) & (v) and an advance knowledge of sub-section (iv). The difference between the GISc Technologist and GISc Professional is one year of study at NQF level 8 (including a research project), implying that the GISc Professional has more advanced theoretical knowledge and accountability than a GISc Technologist.

To be used in conjuction with knowledge area (KA) content specifications
One credit is considered to be 10 hours of notional learning
KA teaching may be included in more than one course / module
10% leeway per KA is allowed as long as there is no material impact on the qualification

Date Approved: 22 April 2015

Knowledge area (KA)	Outcomes	Units	Themes and key words	Credits for Unit	Total credits for KA	%
GSc: Geographical science	Understanding Geographical sience as it relates to GISc				24	5
		GSc1 Area and spatial analysis	Comprises the reading, analysis and interpretation of spatial information; Basic concepts and terminology. Place and landscape. Broader understanding of what GIS is and what it involves. Geography as a foundation for GIS. Historical perspective. Application fields. Understand different fields contributing and forming part of GISc. Components of a GIS. Functionality, analysis and processess involved.	12		
		GSc2 Earth and environmental science	GIS in earth and environmental studies: A combination of any of the following: Climatology, Geomorphology, Hydrology, Ecology structural geology, engineering geology, interpretation of geological maps, integrated environmental management, environmental impact assessment, development science and theory, urban systems and human settlement, population geography, Disasters (natural and manmade), sustainable development, natural environmental systems (water, atmospheric, oceanographic, fauna/flora etc.), tourism, conservation (natural or heritage), climate change:	12		
MS: Mathematics and statistics	Applying mathematics and statistics in solving GISc related problems				48	10

		MS1 Mathematics: Introduction to higher mathematics and problem solving.	Differential and integral calculus of functions of one variable, differential equations, partial derivatives, Taylor series, mean value theorem, solving systems of linear and non-linear equations, trigonometric functions, hyperbolic functions, conic sections, complex numbers, vector geometry, matrix algebra, eigen vectors and values, linear transformations, space curves and surfaces, differential geometry. Series and polynomials. Basic statistics: regression, distributions, error theory, correlation, sampling. including sets, probability, permutations and combinations, and mean, standard deviation.	48		
PS: Physical science	Understanding the principles of Physics in geomatics practice, instrumentation and technology related to GISc				12	3
		PS1 Kinematics, Newton's laws of motion, Friction, Momentum, and work.	Kinematics, Newton's laws of motion, work, energy, power, rotational dynamics, torque, angular momentum, gravity, periodic motion, simple harmonic motion, interference, wave motion, diffraction, refraction and reflection of waves, Doppler effect, electricity and magnetism, electromagnetic spectrum. Optics.	12		
AM: Analytical methods	Understanding and applying different analytical methods related to GISc				48	10
		AM3 Geometric measures	Distances and lengths; direction; shape; area; volume proximity and distance decay; adjacency and connectivity; Terrain Analysis.	12		
		AM4 Basic analytical operations	Buffer; overlay; neighborhoods; map algebra	12		
		AM5 Basic analytical methods	Point pattern analysis; Kernels and density estimation; Spatial cluster analysis; Spatial interaction; Analyzing multidimensional attributes; Cartographic modeling; Multi-criteria evaluation; Spatial process models; Geostatistics; Network analysis.	12		
		AM7 Spatial statistics	Graphical methods; Stochastic processes; The spatial weights matrix; Global measures of spatial association; Local measures of spatial association; Outliers; Bayesian methods	12		

CF: Conceptual Foundation	Understanding the information technology environment				24	5
		CF7 Introduction to information technology, domains and elements of geographical information	Computer hardware, operating systems, data communications (local and wide area cover networks), word processing, spread sheets, internet, systems development (including systems analysis and design), distributed systems, CAD, security of systems and data/information, data storage, data dissemination, spatial data integration (coordinate systems, projections, resembling rasters). Geographic phenomena, geographic information, and geographic tasks are described in terms of space, time, and properties. Elements of GI i.e. discrete entities, events and processes, fields in space and time, integrated models.	24		
CV: Cartography and visualization	Understanding and applying cartography and visualization tecqniques				24	5
		CV2 Data considerations	Source materials for mapping; Data abstraction: classification, selection, and generalization; Projections as a map design issue.	8		
		CV3 Principles of map design	Map design fundamentals; Basic concepts of symbolization; Color for cartography and visualization; Typography for cartography and visualization; Visual perception, graphicacy, cartographic communication (including information sense-making, information use and information-knowledge transformation), graphic space, symbology (point, line, area, pictorial, 3-D), colour, cartographic design, typonomy, generalisation, map use, multimedia mapping, data visualisation, 2-D and 3-D visualisation, interactive maps, Web maps, general purpose maps, relief representation, thematic maps (including statistical mapping), Virtual globes. Presentation and manipulation of point clouds.	8		
		CV6 Map use and evaluation	The power of maps; Map reading; Map interpretation; Map analysis; Evaluation and testing; Impact of uncertainty.	8		
DA: Design aspects	Understanding and applying the design aspects of databases for geospatial data,				24	5

		DA4 Database design	Modeling tools; Conceptual model; Logical models; Physical models.	24		
DM: Data modelling	Understanding and applying DBMS and Data modelling				36	8
		DM2 Database management systems	Co-evolution of DBMS and GIS; Relational DBMS; Object-oriented DBMS; Object-relational DBM; Extensions of the relational model. Data mining. Spatial data structures i.e. lists, R- and KD-trees.	12		
		DM3 Tessellation data models	Grid representations; The raster model; Grid compression methods; The hexagonal model; Terrain models including the Triangulated Irregular Network (TIN) model; Resolution; Hierarchical data models.	12		
		DM4 Vector and object data models	Geometric primitives; The spaghetti model; The topological model; Classic vector data models; The network model; Linear referencing; Object-based spatial databases.	12		
DN: Data manipulation	Implementing data manipulation in a GISc environment.				24	5
		DN1 Representation transformation	Impacts of transformations; Data model and format conversion; Interpolation; Vector-to-raster and raster-to-vector conversions; Raster resampling; Coordinate transformations; Data fusion.	16		
		DN2 Generalization and aggregation	Scale and generalization, caveats of generalising algorithms (Douglas-Peuker) and auto-snap-up routines; Approaches to point, line, and area generalization; Classification and transformation of attribute measurement levels; Aggregation of spatial entities.	8		
GC: Geocomputation	Compiling basic computer programmes in a geographical information system.				36	8
		GC10 Computer programming	Algorithms; Standard query language (SQL); Imperative and functional programming language; Agent based models; Celular automata; Software development for desktop and mobile devices.	36		
GD: Geospatial data	Understanding working with Geospatial data				72	15

		GD1 Earth geometry	Earth's shape; geoid, spheres and ellipsoids	8		
		GD3 Georeferencing systems	Geographic coordinate system; Plane coordinate systems; Linear referencing systems. Two- and three-dimensional coordinate systems, grid reference systems, geographical coordinates; SA Survey co-ordinate system and UTM system.	8		
		GD4 Datums	Horizontal datums; Vertical datums. Reference datums.	8		
		GD5 Map projections	Map projection types and characteristics; Georeferencing; mathematical models of projection and projection properties; Reprojections.	8		
		GD6 Data quality	Primary and secondary sources, Geometric accuracy; Thematic accuracy; Logical consistency, Resolution; Precision; Metadata. Completeness and temporal quality. Digitsing and editing of data.	8		
		GD7 Land surveying, land law and GPS/GNSS	Survey theory and electro-optical methods; Land law: South African cadastral survey system and the Land Survey Act and Regulations, registration systems.Global Positioning System (GNSS).	12		
		GD10 Aerial imaging and photogrammetry	Principles of analogue and digital photography, photogrammetric measurement and data processing including geometry of images, relative and absolute orientation, bundle adjustment and aero triangulation, ortho-rectification, mosaicing, digital elevation models. Accuracy and reliability assessment of photogrammetrically derived data, image (photo) interpretation, creation of 3D computer model of landscapes settlements and buildings. Virtual globes.	8		

		GD11 Satellite and shipboard remote sensing	Earth radiation model and electro-magnetic spectrum, electo-magnetic energy in remote sensing, sensor systems (airborne, space borne and terrestrial), satellite orbits, geometry of sensors and sensor systems (airborne and satellite), acquisition of images, image media and formats incl. image compression. Nature of multispectral image data; Platforms and sensors; Algorithms and processing; Ground verification and accuracy assessment; Applications and settings; image processing (including image enhancement, image feature extraction, classification). Application of terrestial and aerial laser scanning. Hyperspectral; radar remote sensing.	12		
GS: GI S&T and society	Applying professionalism and ethics in the GISc environment				12	3
		GS6 Ethical aspects of geospatial information and technology	Ethics and professionalism in the GISc practice; Codes of ethics for geospatial professionals; Codes of conduct in the GISc field. Legislation regulating the profession. Intellectual property rights and copyright, privacy rights	6		
		GS8 Business and project management	Effective communication within the built environment (written and spoken communication, communication in the workplace); Management functions (planning, controlling, organising, decision-making), human resource management, financial management and management accounting, marketing and client relations, labour legislation, taxation, project planning, costing, resource allocation, project control and reporting, business communication, report writing, contract law. Risk management and Health and Safety management	6		
OI: Organizational and institutional aspects	Operating in the Geomatics Industry				12	3
		OI5 Institutional and interinstitutional aspects	Spatial data infrastructures; Adoption of standards; Metadata; Data transfer and exchange; Spatial data sharing among organizations; Openness; Balancing data access, security, and privacy; Implications of distributed GI S&T; Inter-organisational and vendor GI systems (software, hardware and systems). Data warehousing.	8		

		OI6 Coordinating organisations (National and international)	National and international organisations and programs; State and regional coordinating bodies; Professional organizations; Publications; The geospatial community; The geospatial industry	4		
Credits for specialisation					48	10
		Maximum three core KAs		48		
RM: Research methodology	Undertaking research, compile technical and project reports				36	8
		RM1 Portfolio of evidence	Mini thesis demonstrating research and practical skills in the application of relevant competencies applied in the GISc field.	36		
			Total	**480**	**480**	**100**