GUIDELINES FOR THE MINIMUM CORE COURSES IN GEOGRAPHICAL INFORMATION SCIENCE (GISc) FOR REGISTRATION IN THE CATEGORY:

GEOGRAPHICAL INFORMATION SCIENCE (GISc) TECHNOLOGIST

COURSE

	Common Themes (Study areas)	Lectures
1	**Mathematics, Applied Mathematics and Statistics**	**75**
	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, linear transformations, space curves and surfaces, intersection of lines/planes, distance from points to lines/planes, differential geometry. series and polynomials. Statistics: Descriptive Statistics - Univariate: Sampling and the collection of data, frequency distributions and graphical representations. Descriptive measures of location and dispersion. Probability and inference: Introductory probability theory and theoretical distributions. Sampling distributions. Estimation theory and hypothesis testing of sampling averages and proportions (one and two sample cases). Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques. Multivariate statistics: Analysis of variance, categorical data analysis, distribution-fee methods, curve fitting, regression and correlation, th	
2	**Physics**	**20**
	Kinematics, Newton's laws of motion, work, energy, power, rotational dynamics, torque, angular momentum, gravitation, periodic motion, simple harmonic motion, interference, wave motion, diffraction, refraction and reflection of waves, Doppler effect, electric charge and field, electric potential, capacitance, resistance, electric current, electromagnetic induction, magnetic field, electromagnetic spectrum.	
4	**Information Technology**	**20**
	Introduction to computer hardware, operating systems, data communications (local and wide area cover networks), word processing, spreadsheets, internet, software development (scientific/engineering) in a current programming language, systems development (including systems analysis and design), databases and database management systems, 2-D and 3D CAD, security of systems and information, end-user computing, databases and database management systems, data warehouses and data mining.	
5	**Geo-spatial Information Science**	**60**
	Nature of geo-spatial information, geo-spatial information in planning and decision-making, components of a Geographic Information System, data acquisition and manipulation, non-spatial data, feature classification, spatial entities, data structures (vector, raster, hybrid), data modelling, topology, geo-spatial databases and DBMS, spatial analysis, spatial modelling, spatial statistics, design and implementation of GIS, standards for geo-spatial information, metadata and geo-libraries, data quality, data uncertainties, applications (in different fields), 2.5D and 3-D geo-spatial information (including different structures) , temporal, and spatial data infrastructure.	

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	Common Themes (Study areas)	Lectures
4	**Photogrammetry and Remote Sensing**	**60**
	Acquisition of images, image media and formats incl. image compression, principles of analogue and digital photography, photogrammetric measurement and data processsing including geometry of images, ortho-rectification, mosaicing, georeferencing, digital elevation models. Accuracy and reliability assessment of photogrammetrically derived data, image (photo) interpretation , image processing (including image enhancement, image feature extraction, classification). Applications in resource management, topographical mapping, ortho-image maps, applications in land cover and land use studies, interpretation of results, presentation of data/information (both hardcopy and digital). Fundamentals of remote sensing; digital data and image characteristis; multipspectral, thermal and hyperspectral sensing; passive & active sensors; image pre-processing (radiometrical and atmospherical corrections, image enhancement); image classification and analysis. Earth radiation model and electro-magnetic spectrum, satellite orbits; geometry of sensors and sensor systems (airborne and satellite).	
7	**Coordinate Systems and Map Projections**	**120**
	Two-dimensional coordinate systems, three-dimensional coordinate systems, grid reference systems, shape of the Earth, mathematical representations of the Earth (including reference ellipsoids), geographical coordinates, different types of map projections, properties of map projections (including distortions), coordinate transformations, projection–to-projection transformations, reference datums and ellipsoids, SA Survey co-ordinate system and UTM system.	
10	**Business and Project Management**	**40**
	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.	
11	**Professional Practice**	**50**
	Professionalism, professional ethics, different types of professional practices, partnerships and partnership law, structuring a practice, client relationships, SA Council for Professional and Technical Surveyors (including legislation and rules), and social responsibility. (A minimum of 30% of the time must be spend on professionalism).	
12	**Category Specific Research project**	**25**
	The research project must have a system design and or spatial analysis component and include reporting and presentation of final results. The time spend on research topic selection, research proposal, analysis & interpretation, progress reporting, and liaison with research supervisor must be a minimal of 300 hours.	

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	Category specific themes (study areas)	
17	**3D Modelling / Cartography / Visualisation**	**25**
	Visual perception, graphicacy, cartographic communication (including information sense-making, information use and information-knowledge transformation), graphic space, semiotics, symbolization, map representation, colour, cartographic design, typonomy, generalization, map use, multimedia mapping, 2-D and 3-D visualization, interactive maps, Web maps, Virtual Globes, general purpose maps, relief representation, thematic maps (including statistical mapping), image maps, intellectual property and copyright, privacy rights, information economics, computer-assisted cartography systems, and map printing.	
22	**Data Acquisition (from primary i.e. Surveying, GPS observations and secondary sources i.e. digitising; include adjustments and error theory)**	**50**
	Primary data aquisition methods, including surveying techniques, photogrammetry, remote sensing and GPS observations. The nature of observations and data acquisition, types of errors, accuracy, precision, law of error propagation. Data capture from secondary data sources, including digitizig, scanning and manual input. Principles and methods of managing the quality of collected data. The relationship between data quality and their fitness for use in GIS applications. Data needs, data sources, data capture techniques, data integration, data standards. Error modelling and data uncertainty: presentation of spatial data. Data cleaning, migration & manipulation. Metadata collection and capture (sources, national and international standards, use of metadata). Spatial and attribute data transfer formats. Social surveys questionair.	
23	**Geographical Science**	**75**
	Nature of human geography; Demography of world population; Food resources; Urbanisation: models of urban structure, functional areas in cities, cities in developing countries; Politico-geographical organisation: nations and states in conflict, regions in the news; Environmental systems on a global scale: fluvial, arid, karst, coastal and glacial environments; Ecosystems and humans; Utilisation of environmental resources: global occurrence, use and depletion of non-renewable energy, water and soil resources; Introduction to earth systems science; Star-forming processes; The solar system and the earth; Internal earth processes; Mineral- and rock-forming processes; Origin of magma and igneous rocks; External structure of the earth; Formation of continents; Plate tectonics; Sedimentary rocks and the geological record; Geological time scale; Metamorphic rocks and mountain building; Humans and tectonics: earthquakes and volcanoes; The hydrosphere; Surface water processes; Groundwater processes; Theory of the origin and evolution of life.	
24	**Selected Core Themes and ElectivesStudy Areas**	**180**
	University to add lectures/contact hours to any three (3) or more core study areas other than the research project	
	Further time for electives	**100**
	Grand Total	**900**