

**GUIDELINES FOR THE MINIMUM CORE COURSES FOR REGISTRATION IN THE CATEGORY:  
PROFESSIONAL MINE SURVEYOR**

	<b>Knowledge Area</b>	<b>Outcome</b>	<b>Topic / Themes</b>	<b>Credits</b>	<b>%</b>
<b>1</b>	<b>Mathematics and Applied Mathematics</b>	Ability to apply mathematics and statistics in solving mine survey problems	Differential and integral calculus of functions of one variable, differential equations, partial derivatives, Taylor series, solving systems of linear and non-linear equations, trigonometric functions, hyperbolic functions, conic sections, complex numbers, vector geometry, matrix algebra, intersection of lines/planes, distance from points to lines/planes. Basic statistics, probability, permutations and combinations, mean, standard deviation and normal distribution. Euclidean and analytical geometry	<b>48</b>	<b>10</b>
<b>2</b>	<b>Physics</b>	Understanding the principles of physics in mine survey practice, instrumentation and technology	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, Optics	<b>24</b>	<b>5</b>
<b>3</b>	<b>Mine Surveying</b>	Ability to manage advanced mine surveying operations	Theory and Principles of Surveying-Mine Surveying; Units of measure; Coordinate systems; Survey instruments and their use and adjustments; traversing; levelling-Cut and fill, Gradient calculations; tacheometry; Solution of triangles; Area and Volume determination. Distance measurements, angular measurement, Management of instrument errors, calibration and expected precision), spatial reference systems, distance and direction from coordinates, position determination using observed angles/directions, distances, or combinations of these. Setting out of pre-determined positions, heighting, design of horizontal and vertical curves, cross and longitudinal sections, 2-D coordinate transformations, control surveys, topographic surveys. Survey computer applications; triangulation; resection; trilateration; missing data calculations; satellite stations; surveying of ore passes; shaft surveying; curves. Gyroscopic and GNSS.	<b>60</b>	<b>13</b>
<b>4</b>	<b>Information Technology</b>	Ability to apply Information technology in standard mine survey applications	Computer literacy, data communications (local and wide area cover networks), word processing, internet, software development (scientific/engineering) in a current programming language. systems development (including systems analysis and design), databases and database management systems, use of information technology in surveying, security of systems and information. Spreadsheet design and formatting.	<b>24</b>	<b>5</b>

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<b>5</b>	<b>Geographical Information Science</b>	Ability to apply Geo Spatial Information science technology in managing standard mine survey operations	Nature of geo-spatial information, geo-spatial information in planning and decision-making, components of a GIS, data acquisition and manipulation, data structures (including vector, raster, hybrid), data modelling, geo-spatial databases and DBMS, , applications of geo-spatial data using spatial analysis, spatial modelling and spatial statistics, visualisation and representation of geo-spatial information (including digital cartography).	<b>18</b>	<b>4</b>
<b>6</b>	<b>Photogrammetry and Remote Sensing</b>	Ability to apply the principles of photogrammetry and remote sensing in the mining environment	Earth observation satellite, principles of remote sensing (Electromagnetic spectrums, earth observing satellites, classification), geometry of sensors and sensor systems (airborne, UAV, spaceborne and terrestrial), Structure from motion, camera calibration, acquisition of images (including flight planning), principles of analogue and digital photography, ortho-rectification, mosaicing and georeferencing, digital elevation models. Ground Control, Aerial Laser scanning, terrestrial photogrammetry.	<b>12</b>	<b>3</b>
<b>7</b>	<b>Coordinate Systems and Map Projections</b>	Ability to understand the principles of co-ordinate systems and map projections in the mine environment	Two- and 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, Including mathematical models and projection properties) re-projections, reference datums and common ellipsoids, SA Survey co-ordinate system and UTM system.	<b>24</b>	<b>5</b>
<b>8</b>	<b>Adjustments, Error Theory and Statistics</b>	Ability to recognise and adjust observational errors in the mining environment	The nature of observations and data acquisition, types of errors, means, norms ,accuracy, precision, reliability, probability, confidence intervals, distributions and probability density functions, auto- and cross-correlation, hypothesis testing, least squares theory, simple and multiple regression, distribution functions, law of error propagation, least squares adjustments of survey observations( parametric and condition equation case), network adjustment (including free networks), adjustment of coordinate transformations, design of survey networks, statistical analysis of results and interpretation of data.	<b>24</b>	<b>5</b>
<b>9</b>	<b>Earth and Environmental Studies</b>	Ability to contribute to the environmental management of a mine	Environmental pitfalls in minerals exploration, Mining and the environment, Water management, Air pollution from mining operations, Environment impact assessment, Compiling an EMPR, Environment management costing	<b>12</b>	<b>3</b>

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<b>10</b>	<b>Business and Project Management</b>	Ability to communicate and work in a project team within a mining environment	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	<b>12</b>	<b>3</b>
<b>11</b>	<b>Professional Practice</b>	Ability to practice safely within the mining industry's legal requirements	Professionalism, professional ethics, different types of professional practices, structuring a practice, client relationships, social responsibility; Registration with Geomatics Profession Council (including legislation and rules). MHSA, MPRDA, SAMREC and regulations	<b>12</b>	<b>3</b>
<b>12</b>	<b>Category Specific projects / research</b>	Ability to demonstrate technical proficiency by producing a report	The project must have a design, analysis and research component and include reporting and presentation of final results	<b>36</b>	<b>8</b>
<b>13</b>	<b>Cadastral Studies and Land Tenure</b>	Ability to demonstrate cadastral applications in a mining environment	Nature and function of the cadastre, cadastral surveying systems, South African cadastral survey system and the Land Survey Act and Regulations, curvilinear boundaries, legislation applicable to land ownership and division of land and land tenure (including indigenous systems), rights in land (including servitudes, leases, statutory rights).	<b>6</b>	<b>1</b>
<b>14</b>	<b>Precise Mine/ Engineering Surveying</b>	Ability to apply precise surveying techniques to resolve complex mining activities	Shaft Surveying( design and location of survey control), Deformation caused by mining activities, types of deformation, Risk modelling and analysis of deformation survey, Specialized surveying and monitoring equipment (precise Level, total stations, Geomos, Piezometers, inclinometers, hydrostatic levels, including sources of errors, calibration and expected precision). Design of precise control networks, monumentation, automated surveying equipment applications, analysis of data, presentation of data. Terrestrial laser scanning. Standards of accuracy.	<b>30</b>	<b>6</b>
<b>15</b>	<b>Mine Planning</b>	Ability to demonstrate complex mine planning skills	Mine Planning Terminology, Mine Ventilation layouts, Mine Ventilation constraints (gasses, airflow, Health and safety act requirements), Environmental control - airflow, cooling, calculation of volumes of narrow tabular and massive type ore bodies, design of mine development to allow safe holing on gradient, mine design, layout and sequence, deep, intermediate, shallow, single reef/seam, multi reef/seam, wide reef/seam , irregular ore body, pipe deposits, massive ore bodies, stopes, tunnels, large excavations.	<b>18</b>	<b>4</b>

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<b>16</b>	<b>Mineral Management</b>	Ability to demonstrate mineral management skills as required at a mine	Mineral rights with reference to land use systems and types. Mineral and Petroleum resource Act, Mine Health and Safety Act and regulations. SAMREC and SAMVAL codes, land use planning and control, environmental and physical influences, community dynamics, social impacts, integrated environmental management, environmental impact analysis, mining property valuation	<b>18</b>	<b>4</b>
<b>17</b>	<b>Mine Sampling</b>	Ability to apply sampling theory at a mine production unit	Sampling theory and procedures, sampling methods; Sampling reports; Averaging and weighing of sampling results; regular and irregular sampling intervals; Calculation of tonnage and mineral content; ore flow; pay limits; grade control; life of mine; valuation of a mineral deposits; management control factors; present values and compound interest; taxation; borehole valuation; statistical valuation (distribution, probability and regression) sampling and valuation computer applications. Reporting.	<b>18</b>	<b>4</b>
<b>18</b>	<b>Mineral Valuation / Evaluation / Geostatistics</b>	Ability to produce and manage mineral reserves for a mine	Financial mine planning, classical statistics, non-spatial estimation techniques, data analysis, classical and geostatistical estimation methods, ore genesis, structural geology, SAMREC code	<b>36</b>	<b>8</b>
<b>19</b>	<b>Mining Geology</b>	Ability to apply geology knowledge in the management of sampling, survey data and valuation	Mineralogy, petrology, physical geology, structural geology, historical geology, economic geology, prospecting methods, geological maps.	<b>24</b>	<b>5</b>
<b>20</b>	<b>Rock Engineering</b>	Ability to apply rock engineering knowledge in mine planning and monitoring in a mining unit	Purpose of rock engineering, elastic theory, stresses and strains - compression, tension, shear, Young's Modulus, Poisson's Ratio, strength of support materials - rock types etc, convergence, distribution of stress around openings, fracture around openings, effects of geology, factors governing rock behaviour, energy release rate, excess shear stress	<b>24</b>	<b>5</b>
			<b>Grand Total</b>	<b>480</b>	<b>100</b>