

GUIDELINES FOR THE MINIMUM CORE COURSES FOR REGISTRATION IN THE CATEGORY:

PROFESSIONAL ENGINEERING SURVEYOR

COURSE

Lectures

Common Courses

1	Mathematics and Applied Mathematics	175
	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. Basic statistics, including sets, probability, permutations and combinations mean, standard deviation and normal distribution. To be added to allow for changes in matriculation syllabus: Euclidean and analytical geometry, trigonometric identities, laws of sines and cosines, proportion, co-ordinate systems, areas and volumes.	
2	Physics	75
	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.	
3	Basic Surveying and Engineering Surveying	150
	Measurement science, distance measurement (optical, mechanical and electro-optical), angular measurement, measuring equipment (distance and angular, including sources and 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, and Satellite Navigation Systems, setting out of pre-determined positions, heighting, areas, volumes, interpretation of maps/plans, design and setting out of horizontal and vertical curves, cross and longitudinal sections, cut and fill calculations, preparation of maps/plans, 2 D coordinate transformations, control surveys, topographic surveys. Inertial navigation systems.	
4	Information Technology	50
	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, use of information technology in surveying, 2-D CAD, security of systems and information.	
5	Geo-spatial Information Science	25
	Nature of geo-spatial information, geo-spatial information in planning and decision-making, components of a GIS, data acquisition and manipulation, feature classification, data structures (vector, raster, hybrid), data modelling, geo-spatial databases and DBMS, applications of geo-spatial data using spatial analysis, spatial modelling and spatial statistics, visualisation, representation of geo-spatial information (including digital cartography).	

6	Photogrammetry and Remote Sensing	50
	Earth radiation model and electro-magnetic spectrum, satellite orbits, geometry of sensors and sensor systems (airborne, spaceborne and terrestrial), camera calibration , acquisition of images (including flight planning), image media and formats incl. image compression, principles of analogue and digital photography, photogrammetric measurement and data processing including geometry of images, relative and absolute orientation, 3D resection, 3D intersection, bundle adjustment and aero triangulation, ortho-rectification, mosaicing and georeferencing, digital elevation models . Determination of 3-D coordinates in close-range photogrammetry. Accuracy and reliability assessment of photogrammetrically derived data, image (photo) interpretation , image processing (including image enhancement, image feature extraction, classification). creation of 3D computer model of landscapes settlements and buildings. Virtual globes.	
7	Coordinate Systems and Map Projections	50
	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) projection-to-projection transformations, reference datums and common ellipsoids, SA Survey co-ordinate system and UTM system.	
8	Adjustments, Error Theory and Statistics	100
	The nature of observations and data acquisition, types of errors, means, norms ,accuracy, precision, reliability, probability, confidence intervals, distribution and probability density functions, estimation, 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, data filtering (incl. Kalman filter). General Combined case, combined case, parametric case with conditions, adjustment of best fitting geometry and 3D rigid body transformation, goodness of fit test, errors of type I and II. Deformation analysis models.	
9	Earth and Environmental Studies	50
	Geomorphology, structural geology, engineering geology, interpretation of geological maps, integrated environmental management, environmental impact assessment.	
10	Business and Project Management	25
	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	25
	Professionalism, professional ethics, different types of professional practices, partnerships and partnership law, structuring a practice, client relationships, SA survey profession and SA Council for Professional and Technical Surveyors (including legislation and rules), social responsibility.	
12	Research project	50
	The research project must have a design and or analysis component and include reporting and presentation of final results	

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Category specific courses		
14	Geodesy and Satellite Surveying	50
	Earth gravity field, earth rotation dynamics and reference systems, geocentric coordinate systems, gravity observations, geoidal studies, tidal effects, datum and datum shifts, geodetic surveying, global positioning satellite systems, satellite orbits and orbital parameters, time systems, 3-D positioning.	
16	Precise Engineering Surveying	50
	Specialised instrumentation (including sources of errors, calibration and expected precision), precise engineering surveying methods, precise heighting methods, design and optimisation of networks, precision surveys for construction and industrial applications (including precision alignment), deformation surveys and monitoring, analysis and interpretation of results, presentation of results. Setting out of tunnels , bridges, dams, tall buildings and industrial structures, including supervision and monitoring.	
17	3D modeling/Cartography / Visualisation	50
	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, toponomy, generalisation, map use, multimedia mapping, 2-D and 3-D visualisation, interactive maps, Web maps, general purpose maps, relief representation, thematic maps (including statistical mapping), image maps, intellectual property rights and copyright, privacy rights, information economics, computer-assisted cartographic systems, map printing.	
Further time for electives		275
		1250