### ELCM101 Calculus I
Real numbers, field of the real numbers, Numerical sequences, functions, limits, Continuity, derivability’s of function, plotting exponential and logarithm curves, parametric curves. Finite expansion, Taylor formula, Indefinite and Definite Integrals.

### ELCM102 Linear Algebra I
Set theory, Algebra structures, Complex numbers, Vectorial space, Linear applications, Matrices: determinants, Systems of linear equations.

### ELCM103 General Properties of Matter
Elastic properties of materials, heat transfer, thermal properties of materials, first and second principle of thermodynamic, Heat capacity and specific heat entropy change for irreversible process, entropy and performance of engineering and refrigerators, enthalpy, static of fluids, pressure and density, pascal’s principle and Archimedes’ principle. Surface tension and capillarity, Dynamics of perfect and of real fluids, General concepts of fluid flow, Bernoulli’s equation and its application, viscous fluids.

### ELCM104 Waves and Vibrations
Oscillating systems, simple harmonic oscillator, simple harmonic motion, Energy in SHM, Circular motion, Damped harmonic motion, forced oscillation, resonance, two body oscillations, mechanical waves traveling waves, wave speed and stretched string, wave equation, energy in wave motion, superposition of waves, standing waves, traveling sound waves, speed of sound, power and intensity of sound waves, standing longitudinal waves, vibrating systems and sources, beats, Doppler effect.

### ELCM105 Computer Applications
Introduction to computer systems, hardware and software, peripherals, PC operating systems, keyboarding, Word, Excel, power point, internet.

### CLEN101 Remedial English

### CLFR101 Remedial French

### CLAR101 Remedial Arabic

### HLAL101 Islamic Culture
General Introduction, man and culture, man and ancient cultures, man and religions, legislation.

### ELSV101 Topography I
Definition, units and scale, geodetic and plane survey, basic survey method, – distance measurement by taping, sources of errors, equipments, - Leveling, theory, field and procedure instrument, setting up a level, differential and reciprocal leveling, bookings of readings, sources of errors. – Mathematic. Model and trigonometric equation Measurement and errors, direct and indirect meas. Types of errors, errors propagation.

### ELSV102 Technical Drawing I
Dimensions; Standard lettering; Designer equipment and drawing terminology; Convention of representation: format, cartridge, folding, scales; Drawing presentation; Geometrical constructions: parallel and perpendiculars lines, angles; Geometrical layout; lines division.
ELCM201 Programming I (Algorithm and C Language)
user-defined types, selection, loops, arrays, records, strings, pointers, files, heterogeneous data structures, functions and routines, program design, structured programming techniques, testing and debugging, basic algorithms, (assignments and project).

ELCM203 Calculus II
Parametric and polar curves, Indefinite and Definite Integrals, Improper Integrals, Numerical Series, Vector functions, Functions of several variables (2 and 3 variables), Double, triple and line Integrals, Surface Integrals, Vector Analysis, fields, gradient, Green’s, divergence, stoke’s theorems and applications, Applications of Integrals of functions of several variables.

ELCM204 Linear Algebra II

ELCM205 Optics

ELCM206 Electrostatic and Magneto static
Electrostatics: Charges, electric field and electric force (Coulomb’s law), Gauss’s law, Energy and potential, Electric dipole, Conductors and Capacitances, Dielectrics and polarization, current and current density. Magnetostatics: Magnetic force and Magnetic field (Biot-Savart law), Ampere’s law, Faraday’s law, induction and auto-induction, Mutual inductance, Inductances, Magnetic materials, magnetic dipoles and magnetization, Introduction to Maxwell’s equations.

ELCM207 Engineering Mechanics I
Errors and accuracy, systems of units, vectors, Motion in one dimension, Motion in two dimension (Projectile, Relative motion), Forces and Newton’s laws, Work, Kinetic energy and Potential energy, Linear momentum and collision, Centre of mass and Moment of inertia, Circular motion, Angular momentum, rotational dynamics, static equilibrium.

CLFR201 Remedial French
CLEN201 remedial English
ELSV201 Topography II
Angular meas. Optical and electronic digital theodolite.- measuring a horizontal and vertical angle, closing the horizon application,- Tacheometry, stadiametric equation ,tangent system ,subtense system Auto reduction instrument.- indirect leveling , trigonometric and geodetic leveling , instruments , correction for refraction and curvature – Area for regular shape.
**ELSV203 Technical Drawing II**

Designer equipment and drawing terminology, convention of representation, format, cartridge, folding, scales, drawing presentation, parallel lines, perpendiculars, angles, geometrical layout, lines division, projections, representation of 3 dimensions (Axonometry), plan, elevation and section.

**TERM3 –SUR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELCM301</td>
<td>Differential Equation and Vector Analysis</td>
<td>Introduction to functions of 2 and 3 variables, line and surface integrals. Differential equations of order 2 and 3 then n. existence, solutions, Vectorial forms, Lagrange methods, Euler function and Bessel function, canonic system of differential equations, and applications, partial derivative equations in R3.</td>
</tr>
<tr>
<td>ELCM302</td>
<td>Programming II (C and visual programming)</td>
<td>Abstract data types, pointers, arrays, files, implementation of data structures, linked lists, queues, stacks, trees, recursion, searching and sorting algorithms, (assignments and project).</td>
</tr>
<tr>
<td>ELCM303</td>
<td>Engineering Mechanics II</td>
<td>Relative movement, tensor and vectors, Dynamic and kinetic tensors, kinetic og contact of two solids, with and without sliding, cinematic of solids, different movement of solid, helicoidally movement, acceleration of solid, theorem of decomposition of speeds and accelerations, Euler angle. Kinetic of solid, kinetic tensor, kinetic energy, mass center, Koenig theorem.</td>
</tr>
<tr>
<td>ELSV301</td>
<td>Topography III</td>
<td>Indirect measurement .sources of errors , systematic and random errors . - Angles , bearings , and azimuth , kinds of horizontal angles, measuring angle by repetition ,reiteration table .instrumentals errors . - Electronic distances measurement Principe , microwave instrument errors in EDM, instrument’s And GPS system.-Spherical trigonometrically formulae ,solution . Measurements on the earth surface.-State plan coordinate projection system. Conformal projection, linear alteration, scale, origin grid and projection length.</td>
</tr>
</tbody>
</table>
### ELSV302 Topometric Calculus I:

### ELSV303 Topographic drawing I:
Procedure and methods of topographical planes drawing; Topographical symbols (sign convention); Axing and briefing on planes survey; Drawing scales; traverses surveys; Plotting.

### ELSV304 AutoCAD:
Introduction; drawing lines; erasing objects; drawing basic chaps; object snap; geometric construction; using layers; placing texts on drawing; basic editing commands; automatic editing; creating multiple objects with arrays; drawing and editing polylines; basic dimensioning practices; hatching; coordinate system; blocs. Blocks with attribute. External references and multiview, three dimensional drawing, coordinates systems, solid modeling construction, volume calculation, drawing contour lines, representing topographic drawing: 2D and 3D.

### ELCM401 Complex Analysis and Series
Function with complex variable (limits, continuity. complex differentiation). Harmonic function. Elementary function (sin z, cos z, log z). Complex integration, Simply and uniformly convergence, Fourier’s series, Fourier’s and Laplace’s transforms, introduction to signals.

### ELCM402 Numerical Analysis
Errors interpolation, numerical quadrate, numerical resolution of differential equations, resolution of non-linear equations, resolution methods of linear systems, interactive construction of curves, numerical Integration. Finite difference project.

### ELSV401 Topography IV
Determination of surveying points network (Azimuth, Surveying intersection, Three – points problem, Traverse) Leveling and Instruments. Surveying of details (Side Shots- Abscissa and ordinates, lateral oblique), Representation of relief (Methods used, Construction of contour lines), Longitudinal profile – Cross sections – Earth word.)
ELSV403 Topometric Calculus II:
Polygonal development; Straight line and curve problems; acreage, surface division, Implantation.

ELSV404 Topographic drawing II:
Survey of existing buildings; Contouring; Leveling; Location of contours by cross-section method; Elevations; Surfaces and Volumes.

ELSV405 Land Development
Screen structure, mouth function, keyboard function, group concepts, table concepts, code concepts, earth file structure, earth modeling, CAD output, volume concepts.

ELSV406 Probability for Engineers

ELSV407 Geometry and Trigonometry
The purpose of this course is to ensure that students understand the fundamentals of both 2- and 3-dimensional geometry. Topics shall include, but not be limited to: patterns of reasoning, proofs, triangles and congruence, parallel lines and planes, quadrilaterals and polygons, similarity, circles, angles, arcs, area, perimeter and volume, and solid geometry.

ELSV408 Training I
Select the best stations sites of local network, measure the length of the sides and the angle, using the total station instrument, adjustment the network and calculate the three dimensional coordinates, with respect to the global geodetic network, setting out the boundary for number of polygons and fixing all details, construct the contour line showing the level of the ground by using the digital automatic level, platting all survey details using (LSCAD and AUTOCAD software)

TERM5 – SUR

ELSV501 Geodesy I:
Introduction to geodesy: definition, relation, objectives, geodesy product, reference surface and coordinates systems: surface of reference, geoid ellipsoid, systems of coordinates, altimetric system geographical coordinates of a point: geodesic coordinates and astronimics on a sphere and on an ellipsoid, parametric representation of an ellipse, normal sections, parametric representation of an ellipsoid arise of meridian ellipse and of a parallel.

ELSV502 Geographical Information System I (GIS I):
Introduction, origin, field of applications, principles and techniques of measurement, Keyboarding, input and socio – economical integration of data. Physical and environmental data integration, GIS matrices, and vectors and their functioning, comparison between GIS matrices and vectors, coordinate systems, cartographical projections, nominal georeferences, data base.
**ELSV504 Land Law I:**  
The real estate system: worldwide adopted regulations, historical evolution in Lebanon, Obligatory and optional works with their administrative, technical and judicial steps. Identification and effects of the deliberation, Identification and deliberation: comparison between obligatory and optional. Real estate registry system in Lebanon: Definition of damaged enrollment documentation (rights, procedures, types, results, correction of material errors, enrollment elimination, enrollment and the passage of time, responsibility).

**ELSV505 Photogrammetry:**  

**ELSV507 Engineering Geology:**  
Sciences of earth, geology of earth (topographic elements of earth, means of study of the crust, study on maps, geological surveying), geological classification of rocks, geological maps.

**ELSV508 Technology of Construction**  
Soil mechanics, Soil and Foundation, Walls and Panels, Floor and pavement and roofing, Bitumen, Piles.

**ELSV 503 Construction and Urbanism Laws**  
License; building positing with respect to road; percentage of construction in a land; field of vision; car parking in building; leveling; building characteristics and dimensions; The legislation framework; operational urbanism; intervention tools in land property; the private procedures in developments.

**ELSV 509 Programming III (Web App)**  
Introduction to internet technology; working with html, css; creating Javascript applications; introduction to XML; introduction to SQL; Introduction to OOP in .NET framework; creating a Website.

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**TERM 6 - SUR**

**ELSV601 Geodesy II:**  
Curves on an ellipsoid: normal curve of a surface, geodesic lines on ellipsoid, clairant's theorem, meridian convergence, first order differential equation, geodesic lenis calculation, direct and inverse problem-spherical trigonometry: generalities, spherical triangle, fundamental formulas, auxiliary formulas, spherical excess calculation, small spherical triangle, Legendre's method to solve a small spherical triangle, application of spherical triangle in geodesy, geodesical networks: theoretical principle, triangulation and its orders. Polygon networks qualities of a geodesical network, establishment of geodesical networks, bureau and field work, intervisibility between geodesical points, height calculation of geodesical signal.
ELSV602 Geographical Information System II (GIS II)
Handling of data base, spatial data base as a model of geographical reality, cartographical layers and spatial objects, spatial objects and formats of data bases, relations between spatial objects, analysis of relations between objects, modeling of complex objects in vector mode, efficient line modeling: the chains, data structures, in matrix mode, hierarchical data structure, quaternary tree structures, ground numerical model irregular triangular networks models, temporal and three-dimensional methods, data inaccuracy and errors handling.

ELSV603 Orthophoto and Photographic Interpretation
Rectification, Rectification procedures, orthophotography, Digital orthophoto, Photographic interpretation

ELSV606 Cartography
Scale, cartographical expression and representation, maps classification.

ELSV607 Map Projection

ELSV608 Structure of Building
Characteristics of materials (concrete, steel), load (permanent, service,…)(ACI code), combination of loads (ultimate, service), design of columns, rectangular and circular columns, design of beams, perched beam, continuous and deep beams, types of slab, types of foundations, retaining wall and piles.

ELSV609 Geoinformatics
Geoinformatics is an introductory course to Geoinformation and Geographical Information system development techniques. The main concepts of the course revolve around: Geodatabases, geospatial data management and processing, statistical analysis, spatial analysis using object oriented programming, and finally open source and web-based GIS. The course content includes presentation of several software applications and programming tools, including but not limited to: ArcGIS, ArcExplorer, Matlab, VBA, VB.Net, database technology, and open source GIS software.

ELSV 610 Hydrology
Introduction; Hydrological Processes in space and time; Water balance and Hydrological Cycle; Continuity Equation; Global Climate System; El Nino; Precipitation and Atmospheric Water; Energy Balance; Evapotranspiration; Snow and Snowmelt; Infiltration- Darcy’s law - Green Ampt and Richards Equation - Groundwater Flows; Ground water in Regional Water Balance Runoff Generation and Stream Response; Systems Approach; Transfer Functions and Unit Hydrographs; Flood Frequency Analyses; Design Flood Estimation; Reservoir and River Routing

ELSV 612 Communication Skills
This course focuses on introducing the main concept of communication skills for engineers. The course has three main topics: Written communication: technical writing of reports, texts, journal and other informational material; Oral Communication with emphasize on presentations, rationalization of design process and development of teamwork and improved coordination; Graphical communication focuses on the main tools used in engineering in the design processes of projects namely preliminary sketches and detailed computer CAD.
**TERM 7 - SUR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELSV701</td>
<td>Remote Sensing</td>
<td>Remote sensing principle, spatial orbitography systems, collectors (optim, thermique, radar), geometry of images, elaboration and characteristics of products, remote sensing applications.</td>
</tr>
<tr>
<td>ELSV702</td>
<td>Global Positioning System I (GPS I)</td>
<td>Introduction: Development and History, overview of GPS: space control and user segment, satellite orbits: orbit description; tracking network; ephemerides, reference systems: equatorial coordinate systems; WGS-84-IT12F; time system, satellite signal: signal structure; navigation message; signal processing, observables: point positioning code pseudo ranges, phase pseudo ranges, errors sources: Dop factor; mask angle; biases and noise; sat source signal propagation; receiver source.</td>
</tr>
<tr>
<td>ELSV703</td>
<td>Roads</td>
<td>Base documents for Highways and streets design: longitudinal profile, Cross sections, volume of earth works. General Investigation: design in plain, choice between several solutions, draft project document, carrying out project document. Geometric design: design speed, design vehicles, traffic volume, roads alignment, intersections.</td>
</tr>
<tr>
<td>ELSV705</td>
<td>Cadastral Surveying</td>
<td>Registration of enrollments and contracts in the real estate registry: procedures, fees, documentations, administrative transactions in the municipalities and governorates, special terms for assignment of the identification and deliberation, Automation of land registry.</td>
</tr>
<tr>
<td>ELSV704</td>
<td>Measurements</td>
<td>Calculus of volumes, volume of terraces, different methods, areas, division of areas.</td>
</tr>
<tr>
<td>ELSV710</td>
<td>Signal Processing</td>
<td>Signals, systems, Laplace transform z-transform Fourier series and transform, fast Fourier transform, filtering and spectral analysis.</td>
</tr>
<tr>
<td>ELSV708</td>
<td>Land Arbitration</td>
<td>The legal arbitration system, the arbitration resources, the scope of the arbitration, the arbitration item, the arbitration decision.</td>
</tr>
<tr>
<td>ELSV709</td>
<td>Digital photogrammetry</td>
<td>The course covers digital imagery and emerging trends and applications in digital photogrammetry (i.e. photogrammetric image processing and DSM generation) and computer vision (i.e. Stereo application).</td>
</tr>
<tr>
<td>ELSV711</td>
<td>Digital Cartography</td>
<td>Map content, design and implementation; Graphical representation; Digital representation visualization; Composing maps and graphics; Presentation and display; Representing non-geographic data through cartographic methods.</td>
</tr>
</tbody>
</table>
**ELSV801 Global Positioning System (GPS II):**
Surveying with GPS: observation technique point positioning; differential GPS; relative positioning; static kinematic RTK, surveying procedure; receiver calibration initialization; observation data processing, mathematical models for positioning; point positioning; differential positioning relative positioning; single ;double, triple, transformation of GPS results; coordinate transformation; height transformation; three dimensional transformation; two dins, application of GPS; navigation and surveying practical consideration; GPS and GLONASS, future of GPS; satellite course.

**ELSV802 Image Processing:**
Automatic cartography, introduction to numerical of images processing, Multi- Scale analysis, inverse problem in remote sensing, lower resolution systems, introduction to numerical photogrammetry.

**ELSV803 Road and other Networks:**

**ELSV804 Astronomical Geodesy:**
Generalities, earth movements, celestial sphere, coordinates systems, times, astrogeodetic determinations.

**ELSV805 Physical Geodesy**
Potential notion, Gravity field, Normal field of gravity, Systems of altitude, Estimation of Geoid, Measurements of Gravity acceleration, Gravimetric Methods, Astrogeodetic Methods, Gravity field outside the Earth, Celestial Methods.

**ELSV806 Theory of measurement Errors**
Generality; Random Errors; Precision and Accuracy; Least Squares Method.

**ELSV807 Urban and Underground Engineering**
Streets, corner cut off, underground passage, streets junction, construction of street, street accessory, bridge, retaining, barrages, airports, tunnel.

**ELSV808 Planning of Projects and contracts**
Tenders and contracts, project steps, project management, project cost estimation, project planning, project schedule, compression of the project duration, management of the project resources, control of the project duration.

**ELSV809 GIS Applications and Modeling**
GIS Modeling Approaches: Deductive vs. inductive reasoning. Flowcharting spatial problems GIS Modeling Examples: Wildfire risk mapping; Types of GIS models; Surface Modeling; Spatial Data Mining

**ELSV809 Training III:**
The training on GPS spitted into 4 parts:- triangulation: observation in rapid static method, download processing and adjustment, transformation from WGS 84 to stereographic system – Survey: survey for site in RTK method (real time cinematic) – implantation: implantation for the same site by RTK method – stop and go: survey for a road by "stop and go" method.
### ELSV901 Drainage and Irrigation
Physical and hydraulic properties of soil, water cycle in nature, hydrology, agricultural drainage, basic calculation of drainage networks, irrigation network design, technique and execution, preventive maintenance.

### ELSV902 Urban Land Division and Estimation:
Land secretion, buildings secretion to different sections, distribution of common real estate, real estate evaluation and estimation.

### ELSV903 Urbanism and Development:
General introduction, visualization of urban planning master, planning, master land utilization, future area plans, assignment, reserve land, intervention in the old town, industrial area transportation planning, public areas: heritage protection plan, rural plan urban structure plan, stages of execution of the plan.

### ELSV904 Underground and Hydrographic Surveying:
Underground surveying: Bearing transport to the underground work, Altitude transport to the underground work, Digging, maintenance and respiration of tunnels. Hydrographic surveying: Theory, nomenclature and gauges of tides, Survey techniques, engineering applications.

### ELSV905 Engineering Transportation:

### ELSV906 Land Improvement:
Private screening and annexation, real improvements in the rural areas, Real improvements in the urban areas, real property improvements and the reconstruction of downtown Beirut, computer system in the surveying works, automation of land registry, Geographic Information System.

### ELSV907 Geomatics of Civil Works:
Linear measurements, practical leveling, Building surveys, Building setting out, Road works, Practice of road works, Drain and pipe-lines.

### ELSV908 Environmental Modeling:
Basic principles and tools of environmental model development. Principles of integrated environmental modeling. Types of models. Tools for model evaluation and analysis. Applications to current and local related modeling issues. Investigates methodology of integrating various spatial analyses and modeling techniques with GIS and RS mainly for environmental and water resources applications. The course seeks to presenting a solid theoretical background in GIS analysis and modeling using practical applications; theoretical/technical aspects of related issues in detail Pre-Requisites: Geographic Information System, Remote Sensing, Image Processing.
### ELSV909 Advanced Remote Sensing:
Introduction to digital image processing; Image Enhancement; Pattern recognition; accuracy assessment; change detection; special topics (lidar applications, hyperspectral remote sensing)

### TERM10 - SUR

#### ELCM1001 Diploma Project
Each student will undertake a project under the direction of a supervisor. This experience builds a research foundation appropriate for further developments. It is designated to answer immediate questions in a selected area related to the student's main interest in the surveying domain. Reporting the results in a report and a public presentation will complete the project.