CIVIL ENGINEERING PROGRAMME

FIRST YEAR

Course: Differential and Integral Calculus I
Class hours: 160
Syllabus: Intervals, inequalities and absolute values. Single variable functions: definition, elementary functions and invertibility. Limit and continuity. Fundamental limits. Derivatives: definition; geometric and kinematic interpretation. Derivative as a rate of change. Differentiation rules, and implicit differentiation. Applications of derivatives. Theorems involving differentiable functions. Analysis of function variation. Optimization problems. L'Hôspital´s rule. Taylor series and approximation error. Antiderivatives. Riemann integrals. Area between curves. Fundamental Theorem of Calculus. Integration techniques. Volumes of solids of revolution. Improper integrals.

Course: Vectors, Curves and Surfaces
Class hours: 80
Syllabus: Vectors in bi and three-dimensional geometric space: definition, addition, scalar multiplication and properties. Dot product, vector projection, cross and triple product. Lines and planes in three-dimensional spaces: equations, relative positions and applications to geometric problems. Definition of curves in two and three-dimensional spaces. Cartesian equations and parameterization of curves in two-dimensional spaces, with an emphasis on lines, circles and conics. Quadric Surfaces. Parameterization of curves in three-dimensional spaces such as intersection of cylindrical, spherical, quadratic and planar surfaces. Vector function ideas. Functions of two real variables: definition, graphical representation and contour lines. Tangent planes and normal lines to surfaces. Partial derivatives: definition and geometric interpretation.

Course: Physics I
Class hours: 160
Syllabus: Theory: physical quantities and their measures. Motion in two or three dimensions. Applied forces. Newton's laws. Equilibrium of particle. Dynamics of particle. Work and kinetic energy. Potencial energy and energy conservation. Power. Momentum, impulse and collisions. Center of mass. Equilibrium of rigid bodies. Laboratory: Physical quantities and their Measures. Measuring instruments. Experiments involving the topics of the subject matter.

Course: Drawing
Class hours: 80 horas
Syllabus: Basic geometric constructions; Projection systems, systems of representation. Reading and interpreting drawings. Technical standards. Sketch orthographic views. Parallel isometric perspective. Auxiliary views and sections, 3D visualization, solid modeling and effects of realism in 3D computer visualization.

Course: Algorithms and Programming
Class hours: 80 horas
Syllabus: Logic. Logic for Engineers. Computer Programming. Algorithm. Flowchart. Data: variables and constants. Numerical, logical, strings and user-defined types of data. Programming structures: sequential, conditional and repetitive. Subroutines. Programming language as a tool for logic development.

Course: General Chemistry
Class hours: 160 horas
Syllabus: Scientific Method; Magnetic Properties; Electronic Distribution; Ionic Bond; Metallic Bond; Molecular Orbitals; Band Theory; Semiconductors; Insulators; Physical-Chemical Properties; Covalent Bond; Lewis Theory; Molecular Geometry (VSEPR); Polarity; Intermolecular Forces; Ideal Gas Model; Real Gas Model (van der Waals); Compressibility Factor; Thermodynamics; Enthalpy, Entropy; Free Energy; Spontaneity; The Study of Chemical Reactions; Equilibria; Chemical Kinetics; Redox Reactions; Electrolysis; Electrochemical Cells; Corrosion.

Course: Engineering Fundamentals

Class hours: 160 horas
Syllabus: Fundamental dimensions. Significant figures. Dimensional analysis. Homogeneity of equations. Systems of units and conversions. Physical measurements and treatment of experimental data. Electronic spreadsheets. Tables and graphs. Curve fittings, linear and non-linear models. Linearization. Trusses, machines and gantries. Optimization. Making prototypes. Oral, written and graphic communication.

Course: Projects and Special Activities I
Class hours: 160
Syllabus: Development of competencies, skills and attitudes relevant to the formation of future Engineer, through electives and student-centered practical activities. Training of interpretation and analysis skills. Problem solving methodologies. Development of engineering projects. Technical visits, lectures, workshops, seminars and technological competitions. Participation In undergraduate monitoring programs, scientific projects and technological research, as well as participation in social responsibility projects.

SECOND YEAR

Course: Differential and Integral Calculus II
Class hours: 80
Syllabus: Partial derivatives: Tangent plane, normal straight. Differentiability. Chain rule and implicit differentiation. Directional derivative and gradient vector. Maximum and minimum values and Lagrange multipliers. Double integrals: definition, properties, polar coordinates and applications. Triple integrals: definition, cylindrical and spherical coordinates and applications. Variable changes in multiple integrals. Vector calculation: vector fields, conservative fields, line integrals, Green's theorem, rotational and divergent operators, surface integrals, Stokes¿s theorem and Gauss¿s theorem.

Course: Computational Mathematics
Class hours: 80
Syllabus: Computer arithmetic / Errors: Type and Propagation / Taylor Series; Matrices and Matrix Operations / Introduction to Linear Systems / Direct Method (Gaussian Elimination) / Iterative methods (Jacobi and Gauss-Seidel) / Stopping and Convergence Criteria / Notions on Conditioning; Algebraic and Transcendent equations / Bisection Method / Newton Method; Approximation of functions / Interpolation / Linear and Polynomial Fit / Transformations / Determination Coefficient; Numerical Integration (Trapezoidal Rule, First and Second Simpson Rules); Solution of Ordinary Differential Equations / Numerical Solution (Euler and Runge-Kutta Methods) / Notions of Stability of the Solution / Errors / Solution of Higher Order Ordinary Differential Equations as a System of First Order Ordinary Differential Equations; Notions of Partial Differential Equations.

Course: Mechanics
Class hours: 80
Syllabus: Frenet frame (Moving Trihedron). Rigid Bodies Kinematics: velocity and acceleration fields, moving reference frames. Rigid Bodies Dynamics: mass distribution, center of mass theorem, angular momentum and angular momentum theorem, kinetic energy and kinetic energy theorem.

Course: Physics II
Class hours: 160
Syllabus: THEORY: Electromagnetic interaction. Electric Field. Gauss´s Law. Electric potential. Eletrostactic energy. Electric current. Magnetic induction. Biot-Savart´s Law. Ampere´s Law. Faraday´s Law. Periodic and oscillatory motions. Simple harmonic motion. Physical concepts of forced oscillations, resonance and damped oscillations. Mechanical waves. Energy propagation. Standing waves. Maxwell´s equations. LABORATORY: D.C. generator. Eletric Field.Filiform conductors. Capacitors. Oscillatory motion. Biot-Savart´s Law. Earth Magnetic Field. Faraday´s Law. Photoelectric effect. Diffraction.

Course: Topography and Geomatics

Class hours: 80
Syllabus: Fundamentals and Purpose of topography, surveying, cartography, geodesy and astronomy. Planimetry: description and application of field material. Measures distances. Alignment to goal. Methods to locate a point. Errors. Planimetric survey methods: surveys made exclusively with linear measurements, magnetic north; expeditious Survey (equipment and procedures); The theodolite and its theory. Surveying with the use of theodolite (field operations and office); True North; Surveys second polygonal open and closed. Development of topographic drawing (plants). Elements altimetry: Leveling (types of leveling). The level and his theory. Leveling compound and simple. Topographic survey. Erros.Curvas level. Development of topographic drawing (plan and profile). Application to Embankment (cubing land). Elementary Geodesy. Aerophotogrametry. Remote Sensing. Imagers. Technical Search and Capture Imagens.Técnicas Interpretation of Images.

Course: Strength of Materials I
Class hours: 160
Syllabus: Statics applied to Strength of Materials. Geometrical properties of an area. Internal forces and moments Diagrams. Axial load: tensile and compression. Pure shear stress: riveted and welded joints. Stresses in symmetrical bending. Bending deformation of straight beams of constant and variable cross section. Plane Stress. Mohr's Circle.

Course: Building Architecture and Universal Design
Class hours: 80
Syllabus: Introduction to architecture. The form and the space, the tectonic expression. Analysis and interpretation of architecture and architectural design. Reading projects. The building and the implantation in the city. Ergonomic and accessibility aspects of the spaces. Needs program, sizing, environmental and legal requirements. Architectural project steps and BIM levels of project development. Practical application of standards and legislation related to accessibility of environments, public facilities and the city.

Course: Graphical Representation
Class hours: 80
Syllabus: Introduction to the concepts of the architecture, engineering and construction industry (AEC). Theory and practice of symbolism of representation in different languages of construction, such as: architectural projects, structure, hydraulics and others complementary projects. Tooling commonly used in civil engineering such as: instrumented design, Autocad and Revit. Calculation, application and representation of architectural elements such as roofs, stairs and ramps.

Course: Engineering and Environmental Geology
Class hours: 80
Syllabus: Definition of Geology. Importance of geology in civil engineering. Origin and constitution of the Earth. Geological processes: erosion; sedimentation; magmatic activity; metamorphism. Mineralogy: genesis; classification; properties. Petrology: importance of rocks in civil engineering; igneous, sedimentary and metamorphic rocks. Tectonism. Structural Geology and structural elements of rocks. Groundwater. Importance of soils in civil engineering. Sedimentary soils and residual soils. Groundwater. Relief formation processes: erosion; mass movements; silting; inundation; subsidies. Geological letters and maps. Tests for soil characterization. Underground investigation. Interpretation of standard penetration tests. Elaboration of geological-geotechnical profiles. Excavation works. Geological risks: concepts, classification and management. Environmental geotechnics: concepts and applications. Practical application of Geology in: foundations; highways; wells; tunnels; dams.

Course: Projects and Special Activities II
Class hours: 160
Syllabus: Development of competencies, skills and attitudes relevant to the formation of future Engineer, through electives and student-centered practical activities. Training of interpretation and analysis skills. Problem solving methodologies. Development of engineering projects. Technicalvisits, lectures, workshopos, seminars and technological compettions. Paticipation in undergraduate monitoring programs, scientific projects and technological research, as well as participation in social responsibility projects

THIRD YEAR

Course: Statistics
Class hours: 80
Syllabus: Descriptive Statistics: tabular and graphical presentations, location, variability and distribution shape measures; Probability: basic concepts, unidimensional random variables and common discrete (binomial and Poisson models) and continuous distributions (exponential, Weibull and Gaussian distribution); Estimation: sampling and estimation concepts, sampling distribution, confidence interval (for a population mean, proportion and variance); Hypothesis Tests: basic concepts, testing a single population mean, proportion and variance; testing multiple population means (ANOVA).

Course: Strength of Materials II
Class hours: 80
Syllabus: Bending: unsymmetrical bending, eccentric axial loading in a plane of symmetry. general case of eccentric axial loading. Torsion. Combined loadings. General state of stress. Three Dimensional Analysis of Strain. Yield Criteria for ductile materials. Fracture Criteria for brittle materials. Buckling of columns.

Course: Theory of Structures
Class hours: 160
Syllabus: Basic methods of structural analysis: introduction. Statically determinate structures: simple beams, frames, trusses, Gerber beams, arches and cables. Influence lines and envelopment internal forces. Simple beams statically indeterminate. Continuous beams - deformations compatibility. Energy Theorems. Theorem of Virtual Work. Displacements Method. Matrix analysis of structures. Introduction to the Finite Element Method.

Course: Transport Phenomena
Class hours: 80
Syllabus: Fundamentals of Transport Phenomena. Introduction to fluid mechanics. Basic considerations. Fluid statics: manometry, forces on flat and curve surfaces, thrust. Introduction to fluids in motion: fluid properties, flow concept, mass flow and the Bernoulli equation. The integral forms of the fundamental laws: integral equation of the conservation of mass, of linear momentum and of energy applied to flows. Dimensional analysis and similitude. Internal flows of viscous fluids. Flow meters. External flows of viscous fluids. Introduction to heat transfer. One-dimensional heat transfer at steady state: conduction, convection and radiation.

Course: Soil Mechanics and Earth Structures
Class hours: 160
Syllabus: Phase relationships. Grain-size distribution. Atterberg Limits. Classification of soils. Relative density and consistency. Total, effective and pore stresses. Stress distribution. Capillarity. Permeability of soils. Seepage force. Flow nets. Compressibility and consolidation of soils. Shear strength of sands and clays. Soil compaction. Slope stability. Earth pressures and retaining walls. Embankments on soft soils. Laboratory experiments.

Course: Electrical Building Installation
Class hours: 80
Syllabus: Electrical measurements in DC and AC current; AC Power; Transformers; Triphasic circuits, applications; Electrical installations and types of grounding in buildings; Standards and Safety regulations in electrical installations; Illumination techniques; Automation and control circuits.

Course: Civil Construction Materials
Class hours: 160
Syllabus: Course content introduction and conceptualization. Standardization. Principles of materials science. Physical, chemical, electrical, thermal and acoustic properties. Steel and metal materials for construction. Woods. Ceramics. Bonding materials. Aggregates. Hydraulic concretes. Mixing water. Concrete mix design. Properties of concrete in fresh and hardened state.

Experimental (rational) and not experimental (empirical) rates determination. Concrete production techniques. Additives. Concrete technological control. Mortars. Glasses. Polymers. Bituminous materials. Sealing elements and components. Coatings for walls and floors. Paints and varnishes. Impermeabilisers. Construction materials tests.

Course: Building Construction
Class hours: 80
Syllabus: Conception and design, construction and maintenance of buildings. Building Information Modeling - BIM. Dimensions and levels of development. The building and its parts. Execution of retaining walls and foundations, superstructure, vertical and horizontal fences, covers, linings, waterproofing, frames, facades, glasses, paints and coatings. Final services and delivery of the work.2D and 3D documents, analysis of projects from different disciplines. Construction systems and processes: concrete, structural masonry, metallic, steel frame, concrete wall and engineered wood. Constructive rationalization and modular coordination. BIM tools, analysis and project compatibility, coordination, manufacturing, construction management and project maintenance. Federated model and interoperability. Identification of interferences. Descriptive memorial, quantification of inputs for a work, work schedule, documentation. Performance standard. Stages of the building work. Construction site implementation. Site logistics, BIM 4D.

Course: Projects and Special Activities III
Class hours: 160
Syllabus: Development of competencies, skills and attitudes relevant to the formation of future Engineer, through electives and student-centered practical activities. Training of interpretation and analysis skills. Problem solving methodologies. Development of engineering projects. Technicalvisits, lectures, workshopos, seminars and technological compettions. Paticipation in undergraduate monitoring programs, scientific projects and technological research, as well as participation in social responsibility projects.

FOURTH YEAR

Course: Entrepreneurship and Management
Class hours: 80
Syllabus: Brief history of the evolution of the Business Administration in the modern World.Systemic vision of a company, through the General Theory of Organizations Conceptualization and practical application of: Strategic Planning, Marketing Planning, Operations Planning and Financial Planning, through the design of a Business Plan of a new company, thus encouraging the entrepreneurial spirit of the students.

Course: Urbanism
Class hours: 80
Syllabus: Introduction to Urbanism. Fundamental concepts and tools of urban planning. Analysis of the different modes of territory development in their various scales. Theory and practice of urban planning. The evolution of cities over time. City reading and urban intervention. Urban and environmental legislation. Development of urban land subdivision project using BIM software.

Course: Highways and Urban Roads Design
Class hours: 120
Syllabus: Geometrical Design - General Considerations, elements of the platform, technical characteristics for development of a highway project. Preliminary studies, draft plan / basic design, final design. Horizontal curves. Vertical curves. Superelevation. Widening. Intersections, returns and access. Additional lanes for slow vehicles. Earthwork project, volumes, Brückner diagram. Earthmoving equipment. Locomotion of equipment. Execution of earthwork. Operation and maintenance of equipment. Economic studies of equipment. Paving - Loads acting and materials used. Pavement design: Flexible and Rigid Pavements. Pavement construction. Reinforcement and maintenance of pavements.

Course: Concrete Structures
Class hours: 160

Syllabus: Introduction to structural concrete. Structural safety: probabilistic concepts and the limit state method (ELU and ELS). Introduction to structural design: structure of a building, loading on building structures, loads on structural elements and wind action. ELU design - Normal (FNS, FNC, FOC, and Interaction Diagrams) and tangential (shear and torsional) stresses. Column design. Global stability and 2nd order effects. ELS check: deflection limits and cracking opening limits and checks. Detailing of slabs, beams and columns. Introduction to Prestressed Concrete: Basic concepts, prestressing systems and types, Limit of Service (ELS), Stress Strength and reinforcement areas, stress losses, and Ultimate Limit Verification (ELU). Structural design of buildings: Integrated system applied to the design of building structures. Interoperability of structural modeling with a BIM application.

Course: Wooden and Steel Structures
Class hours: 80
Syllabus: Types of Structures: Historical notes; Material Properties and their resistances; Advantages of using structural steel; Types of shapes and resistances; Structural Systems; Typical Structures; Structural Components; Bracings; Limit States Design Criteria (Load and Resistance Factor Design); Loads; Dead Loads; Live Loads; Wind Loads: Pressure and Shape Coefficients, External and Internal; Design Resistance: Concepts; Tension Design; Compression Design; Column Buckling; Single Shapes; Combined Shapes; Bending Design; Compact and Semi-compact Beams; Shear Design in Bending; Bolted Connections: Design Criteria; Dowell Design; Nailed Connections; Welded Connections; Plate Connectors Design; Notched Connections; Glued Connections; Column Bases: Pinned and Fixed; Design of Beam-Columns submitted to both Compression and Bending. Project: Structural modeling in a finite element program. Interoperability of structural modeling with a BIM application.

Course: Hydraulic
Class hours: 120
Syllabus: Permanent flow in pipelines. Basic concepts. Uniform flow in pipelines. Head losses in pipes. Hydraulic piping systems. Problem of the three reservoirs. Pipeline way. Siphon. Uniform distribution of flow. Distribution network. Pumping systems: dynamic similarity criteria and cavitation. Pumping systems in series and in parallel. Figurative point of operation. Water hammer. Permanent and uniform flow in open channels. Manning coefficient. Simple and compound sections. Specific energy. Orifices, nozzles and broad-crested weirs. Flow in porous media. Principles of hydraulic design of hydroelectric plants - spillways, stilling basins, hydraulic turbines.

Course: Hydrology
Class hours: 80
Syllabus: Conceptual aspects in Hydrology; hydrological cycle; hydrological budget; water resources; statistic, deterministic and stochastic Hydrology. Environmental impacts of human and engineering actions on the hydrological cycle and budget. Hydrological watershed: definition; identification; characterization. Atmospheric precipitation: concepts and types. Introduction to Hydrometeorology, rainfall studies and Climatology. Hydrometrics: concepts, application to the different phases of the hydrological cycle; practical use of gages, with spillways and velocity meter. Rainfall infiltration; underground, surface and subsurface flow; draughts; evapotranspiration; Limnology. Statistic analysis of hydrologic series; determination of project values; hydrologic risk analysis. Intense rainfall: concepts; importance for drainage and flood control. Determination of project flood flow rate for small and medium size watersheds; unit hydrograph; flood hydrograph; the rational method. Introduction to the components and Hydrology for macro and micro drainage system design. Hydraulic-hydrological studies for flood control and flow regularization reservoirs.

Course: Plumbing Engineering/ Hydraulic Building
Class hours: 80
Syllabus: Drinking water: water demand; water supply and distribution in buildings; design of drinking water systems; operational and maintenance aspects. Hot Water: requirements for hot water in facilities; water heating equipment and distribution system in buildings, hot water domestic system design, operational and maintenance aspects. Sanitary sewer: building collection facilities; ventilation; solutions for treatment and infiltration (where there is no public collection sewer); design of sewage systems of buildings; operational and maintenance aspects.

Rainwater drainage system. Retention of rainwater in buildings. Concept and design of drainage systems - gutters, downpipes, manifolds and small channels. Sizing of drainage systems; operational and maintenance aspects. Hydraulic fire-fighting installation: basic concepts.

Course: Foundations
Class hours: 80
Syllabus: Introduction to Foundation Engineering and soil structure interaction, Brazilian and foreign standards, Brazilian and internationals associations. Safety Criteria: Ultimate Limit State and Service Limit State (allowable settlements). Geotechnical Investigations for foundation design. Obtaining geotechnical parameters by correlations. Main types and execution of foundations. Soil bearing capacity computations, static load test for footings and for piles. Shallow foundation (Types, calculation, load capacity and settlement). Caisson foundations (types, calculation, load capacity and settlement). Pile foundations (types, calculation, load capacity and settlement). Construction procedures. Choice of foundation solution according to soil profile, building loads and site requirements. Notions of dewatering systems.

Course: Projects and Special Activities IV
Class hours: 160
Syllabus: Development of competencies, skills and attitudes relevant to the formation of future Engineer, through electives and student-centered practical activities. Training of interpretation and analysis skills. Problem solving methodologies. Development of engineering projects. Technicalvisits, lectures, workshops, seminars and technological competitions. Paticipation in undergraduate monitoring programs, scientific projects and technological research, as well as participation in social responsibility projects

FIFITH YEAR

Course: Economics
Class hours: 80
Syllabus: Concepts and economic relations: definition of economics. Object of the economy and basic economic problems. Theory and economic analysis: a new microeconomics. Notions of macroeconomics: concept, measures of economic activity and economic policy instruments. International Economics: Balance of Payments and current economic analysis. Brazilian Economy and Contemporary World.

Course: Business Law
Class hours: 40
Syllabus: Fundamentals of Law. Civil Law. Business Law. Trademarks and patent. Labor Law. Tax Law. Environmental Law. Consumer Law. System CONFEA/CREA.

Course: Hygiene and Work Safety
Class hours: 40
Syllabus: Introduction to Occupational Health and Safety in Civil Construction; Great works, great challenges; Work accident repercussions; Regulatory norms applied to civil construction; Organization of the construction site; Safety in deconstruction activities (demolition); Safety in dealing with tools; Work safety in excavations; Working in confined environments; Work at height; Movement of materials and people; Occupational diseases.

Course: Transportation Planning
Class hours: 80
Syllabus: Factors affecting planning. Notions of transport economics. Urban and Regional Transport Planning. Concepts of trip and survey. Transport Network simulation. 4 step models: Trip generation, trip distribution, modal choice and rout assignment. Transportation planning tools. Operational research. Linear and integer programming, and queuing theory.

Course: Bridges
Class hours: 80
Syllabus: Introduction: historical evolution of bridges. Structural systems and Constructive methods in bridges, superstructure, mesostructure and infrastructure. Structural types. Design notions. Construction Materials. Structural behavior and calculation theories. Single and multiple

beam bridges. Precast concrete structures. Representation of the prestressing in the project. Design of a grid superstructure with prestressed beams. Mesostructure and infrastructures of bridges. Dimensioning of support devices.

Course: Sanitation I
Class hours: 80
Syllabus: Water cycle, multiple uses of water, water use for public supply and sources of water. Sanitation Systems: concept, planning, design, operation and maintenance. Drinking Water Supply System: study of water demand and consumption, water loss rates, design of water supply systems, superficial and groundwater use, raw and treated water piping, distribution tanks, pumping stations, distribution networks. Wastewater system: design of sewage systems, operation of sewage systems, hydraulic design of sewage networks, pumping systems, outfalls, inverted siphons. Rainwater Drainage System: design, operation and design of drainage systems. Quality of water, quality parameters, classification of water bodies and water bodies self-purification.

Course: Planning in construction
Class hours: 80
Syllabus: Planning: concepts. Production chain of Civil Construction. Project and Management Construction Project. Work Breakdown Structure Project: WBS. Schedules, activities and precedence. Gantt technique, networks PERT / CPM; representations ADM / PDM. Durations, productivity and team dimensioning. Line of balance. Softwares of schedules, example with MSProject. BIM for planning, example with Navisworks. Construction costs: cost, price and value. Direct and indirect costs, Overhead. Costs of materials, labor, social charges. Costs of equipments. Budgets: quantification, unit compositions, prices. ABC curves. Estimating. Physical and financial planning, "S" curve.

Course: BIM Technology and Management
Class hours: 80
Syllabus: Lifecycle of projects. BIM 5D. BIM workflow. People management. BIM Execution Plan. Interoperability, communication between disciplines, IFC - Industry Foundation Classes and OpenBIM format, BCF - BIM Collaboration Format. Programming, Planning and Control of all stages of a Civil Work. Management of federated models. Virtual Design Construction- VDC, ICE, Lean Construction and BIM sections. Agile management in civil construction, PMBOK. BIM in the context of inspection and construction management. Risk management, productivity optimization. Site logistics, technological innovations on site. Digital building model, digital twins. Construction simulation, BIM software to monitor the work. BIM in operation and maintenance.

Course: Undergraduate Thesis
Class hours: 160
Syllabus: Introduction: Conceptualization of project. Scientific research and applied research. Project definition: Theme, necessity and justification. Administration and management of projects. Project requirements definitions. Systemic view of the project. Planning: Formation of the team-work. Structure, activities, resources and project budget. Management: Decision. Technical Report and Monograph: concept, characteristics, planning and preparation. Formal presentation: Public presentation skills, attitudes and behaviors, use of audiovisual resources. Public exposition at the EUREKA fair.

Course: Supervised Internship
Class Hours: 160

ELECTIVE COURSES

Course: Railway Infrastructure
Class hours: 40
Syllabus: Permanent way: elements of the superstructure; Material specifications; geometry; construction; drainage; Vehicle-track system; Wheel-rail tension; Sizing; Vibrations and noise;

infrastructure; Sleepers; ballast; Resistance to the movement of trains; Licensing and capacity; Braking; bus; fleet; maintenance.

Course: Airport Infrastructure
Class hours: 40
Syllabus: Introduction. Basic concepts. Federal Airway System. Air traffic control. Airport location. General plan of an airport. Landing area. Terminal area. Air traffic forecast. Introduction to aircraft mechanics. Types, dimensions and speeds. Determination and distribution of weight. Types of landing gears. Turning radius and track length. Geometric design of the landing area. Normative. Rolling lanes. Agreements. Waiting yard. Security devices. Terminal area: charging stations, vehicles and aircraft. Pavement design. Flexible pavement design.

Course: Complementary Topics of Paving-Management of Pavements
Class hours: 40
Syllabus: Diagnosis of the road system: network monitoring, sampling and techniques for data collection. Prediction of pavement performance: performance models of flexible and rigid pavements; Performance modeling processes. Maintenance Alternatives: types of maintenance, unit costs and total paving services. Selection of alternatives, optimization and prioritization of resources: HDM-4 model for floor management systems, for project analysis and road costs. Evaluation of Pavements and Structural Reinforcement Projects.

Course: Computational Modeling of Structures
Class hours: 40
Syllabus: Practical application of the finite element method in linear problems and nonlinear static and dynamic, along with analytical solutions and qualitative understanding of the behavior of structural models of the upper hierarchy. Solutions by Finite Element Method, interpretation of results and critical analysis to verify whether the objectives of the modeling were achieved. Introduction to dynamics of structures. Exemplification of the generation of IFC files in structural design programs.

Course: Design of Structures Computer Aided
Class hours: 40
Syllabus: Structural models for usual concrete buildings. Actions and generating combinations. Study of the action of the wind. Types of structural analysis. 2nd order effects. Modeling ELU and ELS. Global stability. Performance in service. Evaluation of displacements, cracking and vibration. Dimensioning and detailing of slabs, beams and columns. Generate IFC or other BIM-compatible files.

Course: Ports and Coastal Structures and Management
Class hours: 80
Syllabus: Fluvial, coastal and estuary Hydrodynamics and morphology. Hydrometry, Hydrography and Bathymetry. Basic knowledge on sediment transport and survey; physical Oceanography and Limnology; coastal and oceanic Meteorology. Impacts of anthropic and engineering actions on rivers and channels. Riverbank and riverbed stability and protection works. River, waterway and coast management scenario in Brazil. Waterway, channel and lake navigation: vessel characteristics; planning; design, construction and stability of waterways, shore works and manoeuvring basins; amelioration works; dredging; rock removal; environmental impacts and management; operation; maintenance. River shape fixing and regularization works. Structures for level difference overpass. River locks. Tides: hydrodynamic consequences; impacts on navigation and work design. Waves: types, hydrodynamics, propagation, shape changes and effects on civil works and their design. Coastal line and coastal territory defense structures. Oceanic and coastal navigation: vessel characteristics; shore, access and manoeuvring facilities; maintenance; dredging; multidisciplinary aspects. Internal harbour structures.

Course: Sanitation II
Class hours: 80
Syllabus: In conjunction with the Sanitation I discipline, topics related to Sanitary Engineering and Environmental Management are addressed in a complementary way: (a) Water quality standards and classification of water bodies as important parameters for the design of stations

water treatment and sewage treatment; (b) Planning, design, construction, operation and maintenance of sanitary sewage systems, both urban and rural, considering available treatment technologies, dimensioning of processes and components, including the liquid and solid phases of sewage and considering the management and operation for transport and disposal of sludge; (c) Planning, design, construction, operation and maintenance of water supply systems, both urban and rural; and (d) Planning, design, construction, operation and maintenance of systems for the management of municipal solid waste.

Course: Contaminated Area Management
Class hours: 40
Syllabus: Basic concepts of chemistry, soil and groundwater characteristics and their interactions. Engineering and environmental liabilities. Pollution sources and types of contaminants. Conceptual model building. Stages of contaminated area management and remediation and bioremediation technologies. Critical contaminated areas. Rehabilitation of contaminated areas.

Course: Reinforcements in Landfills and Slopes I
Class hours: 40
Syllabus: Analysis of External Stability of Retaining Walls; Notions of numerical modeling applied to Geotechnics; Modeling of Stability Analysis of Slopes; Dimensioning of Reinforced Walls and Slopes with Geosynthetics; Embankments founded on a soft soil works modelling; Anchored Wall Methodology; Numerical Modeling of an Anchored Wall.

Course: Reinforcements in Landfills and Slopes II
Class hours: 40
Syllabus: Analysis of External Stability of Retaining Walls; Notions of numerical modeling applied to Geotechnics; Dimensioning of the Reinforced Earth Wall; Stability Modeling in Earth Dams; Stability Modeling in Concrete Dams Foundations; Modeling an Underground Excavation; Nailing Soil Methodology; Numerical Modeling of Nailing Soil.

Course: Pathology and Therapy of Construction
Class hours: 40
Syllabus: Definition of concepts: pathology, therapy, diagnosis, pathological, repairs, reinforcements, failures, hidden addiction, rehabilitation and maintenance. Methods and tests for inspection and diagnosis of pathological problems. Reactions of chemical and physicochemical deterioration. Aggressive agents and classification of aggressiveness of the environment. Classification and interpretation of cracks in buildings. Materials, systems and repair techniques, strengthening and protection of concrete structures.

Course: Sustainability in Construction
Class hours: 40
Syllabus: Basic concepts associated with sustainability. Sustainability in construction. Green building. Ecoeficiênica and ecodesign. Urban sustainability. Eco-friendly materials used in construction. Durability and sustainability. Analysis of the life cycle. Sustainable construction. Solid waste management in construction. Reverse logistic. Reuse water Rainwater harvesting. Renewables for construction. Quality, Safety, Health and Environment - QHSE. Certification systems of sustainability in construction. Environmental liability. Environmental expertise. Environmental licensing.

Course: Real Estate - Financial Planning
Class hours: 80
Syllabus: Systems of decisions in business and real estate projects. The hierarchy of decision and planning systems for decision making. Risk factors and systems for performance monitoring. The simulation in the economic and financial planning. Construction of scenarios. Currency for projects analysis. Construction of financial flows for decision making in the enterprise environment. Identification of investment and returns flows. Risks in the enterprise environment - Case Studies. The mechanisms for supporting the production process. Financing systems - Case Studies. Brief overview of innovative vehicles for funding: securitization.

Course: BIM: Tools

Class hours: 40
Syllabus: This course presents many of the fundamental concepts of creating BIM models through the application of the tools in Autodesk Revit. Building design, from geometry to construction data. Topics covered: BIM objects, creating and modifying elements and families, planning, appliances and editions of libraries. Basic tools. Schedules and Quantities. Plotting in Revit. The software platforms covered in this course included Revit Architecture, Revit Structure, Revit MEP and Navisworks.

Course: Thermal Comfort and Climatization Systems
Class hours: 40
Syllabus: The purpose of this course is to enable the participant to understand and evaluate the thermal comfort of buildings occupants, as well to describe the main factors affecting thermal comfort. It will be discussed the interactions between the design of a building, thermal comfort and air conditioning systems, taking into account the issue of energy consumption. In this way, the discipline also aims to present basic information about air conditioning systems and designs. The following topics will be presented: What is thermal comfort; Human thermoregulation and metabolism; Variables that influence the human perception of thermal comfort; Thermal comfort in the workplace and legal implications; Concept of thermal load in buildings; Internal and external thermal load; Important parameters for the assessment of building thermal load; Internal and external design conditions; Methodologies for the calculation of thermal load; Standard NBR 16401; The HAP (Hourly Analysis Program) thermal load calculation software; Mechanisms to provide thermal comfort; Forced and natural ventilation; Types of air conditioning systems and their applications.

Course: Underground Structures and Tunnels Topics
Class hours: 40
Syllabus: Introduction to different types of tunnels and underground structures. Geological-geotechnical investigation strategies for projects with tunnels and underground structures. Study the tunnel section based on its purpose. Study of applicable construction methods and excavation methods, considering the induced behavior of the soil and its interaction with the support structure. Know the instability mechanisms and the deformations and stresses of the soil induced by excavations. Study of the conditioning of the soil for the excavations. Know groundwater table lowering and infiltration water depletion systems, as well as their possible impacts. Know the control and monitoring of excavations and study their possible impacts on the surface and structures adjacent to the excavation. Know the sustainability measures of projects that involve tunnels and underground structures.

Note: The student may apply for enrollment in any course offered by the CEUN-IMT, as an elective to complement the required workload, provided it has the approval of the Course Coordinator.