

Transilvania University of Braşov, Romania

Study program: Railways, Roads and Bridges

Faculty: Civil Engineering

Study period: 4 years

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical analysis	AMP01	6	4	3	-	-

Course description (Syllabus): 1. Sequences and Series of Real Numbers. 2. Functions of a Real Variable. 3. Functions of Several Real Variables. 4. Indefinite Integrals. 5. Definite Integrals. 6. Area of a Bounded Region. Arc length of a Plane Curve. Volume of Solid. 7. Improper Integrals. 8. Line Integrals and Green's Theorem. 9. Double Integrals. 10. Surface Integrals. 11. Triple Integrals

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Linear Algebra, Analytical and Differential Geometry	ALGAD01	4	2	2	-	-

Course description (Syllabus): Vector spaces. Euclidean spaces. 2. Linear transformations. Eigenvalues and eigenvectors. Bilinear forms and quadric forms. 3. The vector space of free vectors. 4. Plane and straight line in space. 5. Transformations of coordinates. Translation and rotation. 6. Conics. 7. Quadrics. 8. Generated surfaces. 9. Plane curves. 10. Curves in R^3 . 11. Surfaces.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer programming and programming languages I	PCLP01	4	1	-	2	-

Course description (Syllabus): IBM-PC compatible computer knowledge, physical and functional.

Forming algorithmic thinking, understanding the issues of domain specific engineering and translate them into format appropriate for their proper resolution by computer. Computing facilities offered by learning environment MS Excel.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Descriptive Geometry	GD01	4	2	2	-	-

Course description (Syllabus): This course introduces fundamental principles in developing graphical solutions to engineering problems. It develops the ability to visualize spatial relationships; develop sequential thinking; set patterns of analysis; and spatial visualization through problem-solving. **Topics include:** Basic Concepts of 3-Dimensional Descriptive Geometry: Points; Projection Planes; Orthographic Projection; Views; Auxiliary View. Lines in 3-Dimensional Geometry: Intersecting lines; Skewed lines; Parallel lines; Perpendicular lines; True Length of a line. Planes in 3-Dimensional Geometry: Points and lines on a plane; Dip of a plane; Spatial Relations of Lines and Planes. The methods of the descriptive geometry: Method of replacing projection planes; method of revolution. Solids and Surfaces: Basic techniques for locating points, piercing points, and tangent planes for common solids (prism, pyramid, cone, cylinder, sphere); Development of surfaces; Intersection of geometric surfaces and solids. Descriptive Geometry Applied to Civil Engineering Problems: Roof geometry; Earthworks geometry.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics I	MECC01	5	2	2	-	-

Course description (Syllabus): Mechanics is a science of nature; it studies the mechanical movement laws of macroscopic bodies and is has to answer to such many questions as: for which reasons does a body move and how does it do this?. Mechanics of Rigid Bodies: This course deals solely with the mechanics of rigid bodies. A rigid body is a body which does not deform under the influence of forces. In all real applications, there is always deformation, however, many structures exhibit very small deformations under normal loading conditions, and rigid body mechanics can be used with sufficient accuracy in those cases. Also, the principles of rigid body mechanics are some of the building blocks needed for the mechanics of deformable bodies. The mechanics of rigid bodies is sub-divided into two areas, statics and dynamics, with dynamics being further subdivided into kinematics and kinetics. Statics is the study of bodies in equilibrium. This means there are no unbalanced forces on the body, thus the body is either at rest or moving at a uniform velocity.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Chemistry	CH01	3	2	-	1	-

Course description (Syllabus): Fundamental concepts of chemistry related to the structure (chemical composition, chemical and physical bonding) and properties (physical and chemical) of materials (lime, plaster, cement, metals and alloys, polymers, ceramics, composites) with applications in civil engineering domain; Developing the skills to correlate and integrate the theoretical knowledge of chemistry with/in experimental and numerical applications, including solutions concentrations, chemical reactions, water hardness, metals and corrosion etc.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Scientific writing	SA01	2	1	-	-	-

Course description (Syllabus): The course is designed to teach students some specific writing strategies and to help them see "learning to write" as an engaged, lifelong learning process. Students study the practice and conventions for writing about science and also about the models of science communication that support that work.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Academic ethics and integrity	EIA01	2	1	-	-	-

Course description (Syllabus): Knowledge of the ethical aspects at institution level and individual level; the need to maintain a culture of honesty in all aspects of teaching and research: discourage the plagiarism and student dishonesty (cheating, copying, fabrication or inventing false data), promoting integrity.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign language I – English	LSE01	2	1	1	-	-

Course description (Syllabus): The course covers the core language and skills that the students need to communicate successfully in all technical and industrial specializations. It is for students with a basic knowledge of general English who now require an elementary course in English for specific purposes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Building Materials	MC02	5	3	-	2	-

Course description (Syllabus): This course provides an introductory overview of the various building materials used in construction. After receiving an introduction into fundamental principles of manufacturing techniques, physical and

mechanical characteristics, students learn about practical use in civil engineering domain. We are focusing on the following build materials: rocks, mineral binders (such as clay, plaster, lime and cement), aggregates, mortar, concrete, ceramics, glass, steel, wood, bitumen, insulating materials, finishing materials and composites.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physics	FIZ02	4	2	1	1	-

Course description (Syllabus): 1. Introduction: Dimensional analysis. The least squares method. 2. Cinematic: trajectory, speed and acceleration. 3. Dynamics of the material point. The principles of dynamics. Momentum. 4. Ideal oscillations, damped and forced. The resonance phenomenon. Resonance effects for buildings, bridges, etc. 5. Waves. Classification. Flat and spherical waves. Seismic waves. Properties. Applications. 6. Thermodynamics - introductory notions. Temperature. 7. Principles of thermodynamics. Consequences. Entropy. The laws of ideal and real gas. 8. Thermal properties of bodies. Thermal transfer through conduction, convection and radiation. 9. Electromagnetism. Electrostatic field. The laws of Ohm, Joule and Kirchhoff. Magnetic field. Magnetic induction, force electromagnetic and Lorentz force. Electromagnetic waves. 10. Geometric optics. Optical devices: Optical dioptr, mirrors, lenses, optical prisms and telescopes. Applications of optical devices in measurements, topometry and building surveying.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Topography	TOP02	3	2	-	2	-

Course description (Syllabus): The course aims to familiarize the students with the notions of topography, having as final objectives two main aspects: -understanding of a topographic plan, including the requirements for its drawing (content, significant details, projection and reference system) and the limits of the content of a plan (errors, accuracy, precision).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engineering drawing and computer graphics I	DTI02	3	-	-	3	-

Course description (Syllabus) : The course of the TECHNICAL AND INFORMATIC DESIGN, through its content and level of problem approach, falls within the category of specialized disciplines and it is useful for those who will study and will continue to work in the field of constructions. The technical drawing is the activity of representation on a single plane, according to certain norms and conventions of the objects in the three-dimensional space using the techniques and methods of the descriptive geometry. The technical concept is the only means of representing a conceptual or technical idea and is the main means of linking conceiving and realizing the engineering works. In the course are presented, in accordance with the standards and norms in force, aspects regarding the graphic representation of the resilience plans and the architecture for the civil and industrial buildings.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of Materials 1	RM02	6	3	2	-	-

Course description (Syllabus): The course covers the following topics; stress and strain concepts, axial load, statically indeterminate axially loaded members, thermal stress, torsion, angle of twist, statically indeterminate torque-loaded members, bending, eccentric axial loading of beams, transverse shear, shear flow in built-up members, stress and strain transformation, statically indeterminate shafts. Simple techniques are presented to analyze deformation/strains as well as forces/stresses in linear elastic structures under mechanical loading. Course Objectives: 1. To provide the basic concepts and principles of strength of materials. 2. To give an ability to calculate stresses and deformations of objects under external loadings. 3. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mechanics II	MECC02	5	2	2	-	-

Course description (Syllabus): Kinetics is a part of mechanics that describe the motion of the bodies without reference to the forces which either modify the motion or are generated as a result of the motion. Kinetics is often called the geometry of motion just for the specific reason: it is a study of the motion from the only geometric point of view. Kinematic principles are often applied to the analysis of machine members to determine positions, velocities, or accelerations at various parts of the machines' operation. Dynamics is the most general part of mechanics. Dynamics is the study of bodies which are not in equilibrium, thus there is acceleration. Dynamics studies body movements taking into account the forces that act upon them.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign language II – English	LSE02	2	1	1	-	-

Course description (Syllabus): The course covers the core language and skills that the students need to communicate successfully in all technical and industrial specializations. It is for students with a basic knowledge of general English who now require an elementary course in English for specific purposes

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice topography (30 hours/semester)	PT02	2	-	-	-	

Course description (Syllabus): The aim of the practice is to make student see the whole process of a surveying job, to evaluate the amount of physical work, to understand responsibilities and risks.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special mathematics	MS03	4	2	2	-	-

Course description (Syllabus): 1. Differential equations. 2. Symmetric Systems. First Order Partial Differential Equations. 3. Vector Analysis. 4. Complex analysis. 5. Fourier Series. 6. Partial Differential Equations. 7. Laplace Transforms

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Strength of the materials II	RM03	7	3	2	-	-

Course description (Syllabus): Deflection of beam: Area moment, conjugate beam, deflection due to shear, bending of unsymmetrical beams, curved beams, shear flow, shear center, stresses in open sections, theories of failure, buckling, energy methods, laboratory investigation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Statics and stability of constructions I	SSC03	6	3	2	-	-

Course description (Syllabus): The purpose of this course is to study the methods of analysis of reactions, efforts and displacements of statically determined beam structures subjected to external loads. There are studied beam systems, frames, trusses and arches subjected to fixed or mobile forces, displacements and thermal loads. The equilibrium of these systems is expressed using equilibrium equations and the virtual work principle.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hydraulics	HDR03	5	2	2	-	-

Course description (Syllabus): The course aims learning by students of the concepts and basic laws of hydraulics with applications in civil engineering . Addressing to the students who specialize in civil, industrial and agricultural buildings also buildings for railways, roads and bridges, the course detail knowledge of hydraulics to solve engineering problems of buildings in contact with water, as part of civil buildings, bridges, urban and hydraulic structures. Topics include: Physical properties of fluids; Fluid static; Hydraulic Law; Pascal's law; Pressures forces on plane and curved surfaces; Archimedes' Principle. Uplift; Laws of hydrodynamics; Steady flow in pipelines - energy losses; Steady effluent flow; Steady uniform flow in open channels; Energy study of open surface flow; Gradually varied unsteady flow- backwater curves; The hydraulic jump; Hydraulic calculation of spillways and energy dissipators; Hydraulic calculation of small bridges; Groundwater flow fundamentals; Wells and drains calculation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engineering drawing and computer graphics II	DTI03	4	-	-	4	-

Course description (Syllabus): The course of the TECHNICAL AND INFORMATIC DESIGN, through its content and level of problem approach, falls within the category of specialized disciplines and it is useful for those who will study and will continue to work in the field of constructions. The technical drawing is the activity of representation on a single plane, according to certain norms and conventions of the objects in the three-dimensional space using the techniques and methods of the descriptive geometry. The technical concept is the only means of representing a conceptual or technical idea and is the main means of linking conceiving and realizing the engineering works. In the course are presented, in accordance with the standards and norms in force, aspects regarding the graphic representation of the resilience plans and the architecture for the civil and industrial buildings.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engineering geology	GEO03	2	1	-	1	-

Course description (Syllabus): The course presents general notions in geology (mineralogy, petrology, tectonics, hydrogeology, rock mechanics etc.). The aim is to be able to know and evaluate geological risks for construction.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign language III – English	LSE03	2	1	1	-	-

Course description (Syllabus): The course covers the core language and skills that the students need to communicate successfully in all technical and industrial specializations. It is for students who have completed Level I, or have an elementary knowledge of general English, and now require a pre-intermediate course in English for specific purposes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Building thermotechnics	TERM04	3	2	1	-	-

Course description (Syllabus): General notions of thermotechnics; thermal transfer; construction elements of the buildings; heat losses of a building; heat gains of a building; the annual energy need for heating a building; energy certificate of building; technical solutions for building a house with reduced energy consumption and a passive house.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Statics and stability of constructions II	SSC04	6	3	2	1	-

Course description (Syllabus): The purpose of this course is to study the methods of analysis of reactions, efforts and displacements of statically undetermined beam structures subjected to external loads. There are studied beam systems, frames, trusses and arches subjected to fixed or mobile forces, displacements and thermal loads. These systems are studied using the force method and the displacement method.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer programming and programming languages II	PCLP04	4	1	-	3	-

Course description (Syllabus): This course is an introduction in Scilab programming. It describes the basic elements such as usage of variables in Scilab, fundamental commands, syntax and terminologies. At the laboratory, students are writing simple programs for scientific computations using functions, matrix operations and plotting graphics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The theory of elasticity and plasticity	TEP04	4	2	1	-	-

Course description (Syllabus): Ability to formulate and solve plane problems of elasticity and plate bending problems. Familiarity with variational methods. Familiarity with formulation of problems of plasticity and solution methods. Understanding of notion of limit load.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete and prestressed concrete I	BAP04	5	3	2	-	-

Course description (Syllabus): The subject presents the current norms (Eurocode 2) regarding the calculation of concrete and reinforced concrete elements at the ultimate limit state and serviceability limit state. Knowledge is also presented in terms of the behaviour of concrete elements under the action of various loads. A separate chapter is dedicated to constructive solutions regarding the composition of reinforced concrete.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads for communications	CCOM04	4	2	-	1	-

Course description (Syllabus): The course of ROAD COMMUNICATION, through its content and level of problem approach, falls within the category of General Technical Culture disciplines and is useful for those who will continue to study and work in the field of road and those who only have this branch of construction, helping to better match the specialties. In this paper, design elements related to the characteristics of roads and streets, industrial parks and platforms are made available to those interested. There are presented, in accordance with the standards and norms in force, aspects regarding the design in the plan, long and transverse profile, curve and vertical systematization.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foreign language IV – English	LSE04	2	1	1	-	-

Course description (Syllabus): The course covers the core language and skills that the students need to communicate successfully in all technical and industrial specializations. It is for students who have completed Level I, or have an elementary knowledge of general English, and now require a pre-intermediate course in English for specific purposes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technological practice (60 hours/semester)	PTH04	2	-	-	-	-

Course description (Syllabus): The discipline, within 60 hours, aims to enable the student to appreciate the execution of a building from technical and quality point of view, to understand the technological organization and works mechanization, to know building site organization and management. Verification of accumulated knowledge is done through oral exam - presentation by the student of the activity carried out on the building site.

3rd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Dynamics of structures and elements of earthquake	DS05	6	3	2	1	-

Course description (Syllabus): The course covers the following topics; modeling discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. Calculate the mode shapes and frequencies for the free response of vibratory systems and use modal methods to calculate the forced response of these systems. Calculation of civil structures at earthquake with the simplified level forces method and the modal analysis method. **Course Objectives:** 1. To provide the basic concepts and principles of dynamics of structures. 2. To give an ability to calculate the mode shapes and frequencies for the free response of vibratory systems and use modal methods to calculate the forced response of these systems.

3. To give an ability to apply the knowledge of dynamics of structures on engineering applications and design problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Geotechnical engineering	GT05	5	3	-	2	-

Course description (Syllabus): The course outlines three main aspects: 1. presentation of physico - mechanical properties of soils and rocks (water content and movement of groundwater, porosity, density, state of compaction, plasticity and respectively compressibility, shear strength); 2. the foundation soil calculation: the calculation of settlements, of the load-bearing capacity, stability of slopes, active and passive pressure; 3. the practice of geotechnical works (field and laboratory investigations, support, land improvement, water management, piles etc.)

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Timber construction	CL05	4	2	-	2	-

Course description (Syllabus): Wood used for buildings: advantages and disadvantages; classifications of timber structures and of timber elements; physical and mechanical properties of timber; calculus and dimensioning of timber elements according to Romanian code NP-005/2003 and Eurocode 5 (Design of timber structures) for different types of actions; types of timber jointing – constructive solutions; principals of making timber framing systems for roofs; protection and consolidating of timber elements; constructive solutions for timber structures.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete and prestressed concrete II	BAPD05	3	1	-	1	-

Course description (Syllabus): The discipline presents the current norms (Eurocode 2) regarding the behaviour and calculation of prestressed concrete elements under different loads. There are presented: the basic principles of prestressing, precompression methods, precompression force determination, tension states due to prestressing and external loads for different elements, constructive composition rules.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
General economy	EG05	2	1	-	-	-

Course description (Syllabus): Fundamental principles of economic theories; the notion of property and its role in the functioning of the economy; market, competition and economic balance; specific markets; production process and factors of production; consumer behavior; significant aspects of the international economic environment

Course title	Code	No.of credits	Number of hours per week			
			course	seminar	laboratory	project
Basics of bridge design	BPP05	3	2	1	-	-

Course description (Syllabus): The objective of the course is to acquire knowledge on general elements of construction of bridges. The course presents the technical knowledge needed to initiate in the bridges design activity. The principles of calculation and composition of the road and rail bridge structures are presented, depending on the type of construction material used for the superstructure (wood, masonry, concrete, steel).

Course title	Code	No.of credits	Number of hours per week			
			course	seminar	laboratory	project
Structures for bridges	SP05	3	2	1	-	-

Course description (Syllabus): This course studies the main types of bridges in terms of the static scheme. There are presented the main aspects related to the particularities of the construction and computation of concrete bridges on plates, beams and arches as well as metal bridges on beams and trusses.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Basics of fire safety in construction	SI05	2	2	-	-	-

Course description (Syllabus): Course contents: Introduction to the points at issue, basic terminology and material fire – technical quality. Building fire – technical characterization. Legislative demands and technical norms in fire safety. Building objects dissection on fire sectors. Escape ways design and dimensioning, escape ways types, escape ways principles, evacuation lifts. Fire dangerous building space – distance, fire water- supply system, fire extinguishers. Building constructions fire protection, fire dissection constructions resistance, construction protection. Area planning documentation from fire protection point of view, building fire safety documentation. Specifics in building solution and meeting places on concrete examples. Escape ways design and dimensioning in residential buildings and buildings designed for accommodation, civil buildings, non- production buildings, production objects, storage objects. Simplified building fire protection project elaboration applied on studio creation with accent on escape ways dimensioning.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Urbanism and landscaping	UAT05	2	2	-	-	-

Course description (Syllabus): Introducing the students to the essential elements that define the basics of the Urban and Territorial Planning. Studying the connections between Spatial development, Social Environment, Natural Environment and Geography. Understanding the evolution of the Urban Concepts during the history. Elements of regional planning and development regarding the Romanian Geography and Landscape. The course defines theoretical topics for applied Urban Planning, and essential subjects for understanding the relations between the spatial organization of the localities and the projecting process involved for the local, regional or territorial development fields.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads I	DRU05	3	2	-	-	-

Course description (Syllabus): The course is a comprehensive introduction to road design. It starts with the definition of the relevant technical terms and continues with the road design methodology in plan view, longitudinal profile and cross section. The spatial design of curves and earthworks estimation follows; the course ends with road traffic calculations and the design of highways and crossroads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads I - Project	DRUP05	2	-	-	-	2

Project description (Syllabus): The project deals with road design methodology in plan view, longitudinal profile and cross section. The spatial design of curves, earthworks estimation and road traffic calculations and the design of highways and crossroads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete bridges I	PBA06	4	3	-	-	-

Course description (Syllabus): The course starts with an introduction into the different types of concrete bridges and the relevant technical terms and continues with the detailed description of the roadway for concrete bridges. A detailed design methodology is presented next for two common types of concrete bridges: slab bridges and girder bridges.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete bridges I - Project	PBA06	2	-	-	-	2

Project description (Syllabus): A detailed design methodology is used next for common types of concrete bridges: slab bridges or girder bridges.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads II	DRU06	4	2	-	2	-

Course description (Syllabus): The course covers the road superstructure subject, with emphasis on earthworks, mechanical characteristics of soils, the influence of water on soil behaviour, earthworks deformation under load, execution methods for earthworks, consolidation and protection of earthworks, water collection / drainage and retaining structures.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads II - Project	DRUP06	2	-	-	-	2

Project description (Syllabus): The project covers the road superstructure subject, with emphasis on earthworks, mechanical characteristics of soils, the influence of water on soil behaviour, earthworks deformation under load, execution methods for earthworks, consolidation and protection of earthworks, water collection / drainage and retaining structures.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel constructions	CMT06	3	2	-	2	-

Course description (Syllabus): For Steel Structures are presented introductory notices for the compositions of different steel grades, as well as a description of their behavior at high temperatures, corrosion, aging, fatigue, etc. There are presented the imperfections that occur in the execution of metal constructions, as well as how they are evaluated in dimensioning calculations, and in the design of the steel structures. The second part of the course deals with the calculation, composition and behavior of metallic elements at simple strains (stretching, compression, torsion, bending, shearing) according to Eurocode 3.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foundations	FD06	4	3	-	-	-

Course description (Syllabus): The foundations are structural elements which must ensure the reception and transmission to ground of actions provided by construction in exploitation safety conditions. For this, the choice of a suitable foundation system is very important and must not lead to a request for status change in the other structural elements or the ground under foundations. The content of the course starts from the definition and the role of foundations in the structural composition of a construction, hypotheses and models of calculation, general rules of design, followed by presentation, the calculation and composition in detail of shallow and deep foundations. Therefore, are presented aspects regarding the calculation of the ground supporting, the methods of water evacuation, the calculation, sizing and composition of retaining walls, followed by the presentation, the calculation and composition in detail of shallow foundations (rigid, elastic, isolated, continuous), of deep foundations (on piles, on caissons). The theoretical aspects concerning the works of ground supporting, the calculation, sizing and composition of the retaining walls, of shallow and deep foundations are solved by means of applicative works.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Foundations - Project	FDP06	2	-	-	-	3

Course description (Syllabus): The main objective of this project is to introduce the students into the classical methods for the design of both shallow foundations (retaining walls, continuous foundations, isolated foundations – precast or cast-in-place etc.) and deep foundations (precast piles). After completing this project, the student will understand the design principles, the geotechnical approach and the places where to search the information he needs to complete the future tasks in this domain.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Finite element method	MF06	3	2	-	2	-

Course description (Syllabus): The purpose of this course is to study the basics of the finite element method for structural analysis. There are introduced simple finite elements for plane elasticity, plate bending and three dimensional elasticity problems. The theory is completed by solving simple structures using educational FEM software.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
General course of constructions	CGC06	2	1	-	-	-

Course description (Syllabus): The general objective of this course is to acquire the knowledge regarding the structure, role and functionality of constructions, sub-assemblies and their component parts.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Construction machinery and equipment	MIC06	2	1	-	-	-

Course description (Syllabus): Obtaining the basic knowledge of the machinery and equipment specific to activities in the field of civil and industrial constructions, railway, and road and bridge construction as well as determining their performances for the purpose of the most judicious use. Estimating their productivity and determining the complex of machines needed to obtain the most profitable activities necessary for the construction works. Choosing the optimal type of equipment and cups, blades as well as the machines that compete on the job.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice	PS06	2	-	-	-	90 hours/sem

Course description (Syllabus): Within 90 hours, students will attend and observe various technical processes for building elements on site. In order to correlate with the studied subjects in the third year, it is recommended to

observe the earthworks works, to build foundations of different types, formwork for beams, poles and structural walls of reinforced concrete, as well as the realization of their reinforcement and the casting of the concrete. It is also recommended to follow the construction works of the steel structures.

4th Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete bridges II	PBA07	4	3	-	-	-

Course description (Syllabus): The aim of the course is to acquire the knowledge regarding the elements of conception and calculation of reinforced concrete bridges. The course is designed for the study of road and railway bridges of reinforced concrete and prestressed concrete on beams, frames and arches, as well as their infrastructures.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete bridges II - Project	PBAP07	2	-	-	-	2

Project description (Syllabus): The project contains the design of a road or railway bridge of reinforced concrete or prestressed concrete on beams or frames, as well as their infrastructures.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges I	PM07	3	2	-	-	-

Course description (Syllabus): It aims at acquiring theoretical knowledge for students in the field of knowledge of constructive solutions, structural analysis of steel bridge elements and the joints encountered thereon.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges I - Project	PMP07	3	-	-	-	3

Project description (Syllabus): The project contains the analysis and the design of some basic elements of a steel bridge.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Railways I	CF07	5	2	-	2	-

Course description (Syllabus): Formation of a technical-economic thinking for the design, execution and maintenance of railway infrastructure and superstructure. Acquiring the vocabulary elements specific to the field, understanding the fundamentals and the theoretical underpinning of the regulations in the field, the ability to operate with the knowledge gained in order to understand and achieve specific documentation and projects specific to the railway engineer.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Aided Design	PAC07	3	2	-	2	-

Course description (Syllabus): Advanced finite elements for design structures, use of the matrix displacement method in the stability and geometric nonlinear analysis of plate and shell structures, use of optimization methods in the design of structures, advanced structural engineering software's.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Testing of buildings	INC07	3	2	-	2	-

Course description (Syllabus): This course studies the following issues: methods and devices for measurements in the loading tests of constructions; static and dynamic loading methods and devices; nondestructive test methods and apparatus; designing and organizing testings; time tracking of construction behavior; processing and interpreting the results.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tunnels and metropolitan	TM07	3	2	-	1	-

Course description (Syllabus): This course studies the following issues: The main elements of the underground works; Calculation of underground works; Physical and mechanical properties of rocks; Materials used in underground constructions; Machine tools and equipment used underground; The theory of rock dislocation; Measuring and verification devices; Lighting underground; Ventilation of underground works; Waterproofing of underground works; Technologies for the execution of underground works.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Underground construction	CS07	3	2	-	1	-

Course description (Syllabus): This course introduces the basic notions about tunnels, underground works, wells, subtractions, anchorages, rock consolidation. The student will know how to place, make up each piece of work, technology of execution, sealing of works, determination of pressures, dimensioning of resistance structure, exploitation and maintenance of underground works.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Organizing construction works	ORG07	5	2	-	2	-

Course description (Syllabus): The course is addressed of Civil ,Industrial and Agricultural Constructions students of 4th year, when they have accumulated the knowledges of basis and detail regarding the composition of construction in general and afferent execution technologies. In this context, the course contain the main aspects concerning the organization and planning of construction works from simple processes to technological chains, watching a logical order of operations, the determination of works amounts, during the execution of works, and the number of workers for each operation .By means of this dates are achieved the execution graphs for works (Critical path, etc), for workforce (Gantt, etc), the provisioning and consumption graphs, etc.Also, the course contain basis elements regarding sizing of site management objects with the afferent technological links. The applicative part reflect the theoretical aspects and is focused on organization and planning of the works for a physical status of works or for a part/construction, after case.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Constructions sustainability	SC07	5	2	-	2	-

Course description (Syllabus): European and national environmental legislation, relationships between sustainability requirements and resources used in construction projects, sustainable building materials, eco-labels, environmental impact on the life cycle assessment of a construction product, calculation of the CO2 emissions for all phases of the construction processes, concepts related to recycling and reuse, international systems for voluntary certification (LEED, BREEAM, etc.), energy efficiency of buildings, sustainable design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Environmental engineering	IM07	2	1	1	-	-

Course description (Syllabus):The Environmental Engineering shall make available to prospective builder engineers, theoretical and practical knowledges concerning the current state of the environment, as regards:the impact of human

society on the quality of the environmental factors (air, water, soil, underground, biodiversity, including the health of the population); shall inform on the latest techniques and performance, with low environmental impact, available at the present time, to be used in the anthropogenic activities, including in construction engineering; the organization of activities related to the protection and monitoring of environmental factors, at national and international level; legislation in force relating to the protection of the environment All such knowledge about the environment leading to an understanding of the concept of "sustainable development" which consists, in essence, in the preservation of the existing natural, in order to ensure the welfare of both present and future generations.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Renewable energy sources	SR07	2	1	1	-	-

Course description (Syllabus): general knowledge regarding greenhouse effect, energy savings, wind energy systems, solar basics and thermal solar heating systems, combustion of biomass and biogas, heat pump applications, renewable energy management (tax structures, costs for energy production, cost analyses, environmental issues).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The technology of railway works	TCF08	3	2	2	-	-

Course description (Syllabus): The general objective of the discipline is the formation of technical-economic thinking and the acquisition of the technical knowledge necessary for the initiation in the design activity, and the execution of earthworks related to the railway constructions.. There are presented definitions, notions, concepts, study principles specific to the execution activity, approaching the elements of initiation in the field of infrastructure (earthworks) and the superstructure of modern railways.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The technology of road works	TD08	3	2	2	-	-

Course description (Syllabus): The general objective of the discipline is the formation of technical-economic thinking and the acquisition of the technical knowledge necessary for the initiation in the design activity, and the execution of earthworks related to the road constructions and the aspects specific to the road laboratories. There are presented definitions, notions, concepts, study principles specific to the execution activity, approaching the elements of initiation in the field of infrastructure (earthworks) and the superstructure of modern roads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The technology of bridge and tunnel works	TP08	3	2	2	-	-

Course description (Syllabus): This course presents elements of concreting technology, reinforcement work, preparation of aggregates for concrete, preparation, transport and put into operation of concrete, technology for precast concrete works, manipulation of prefabricated elements and assembly of prefabricated elements.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges II	PM08	2	2	-	-	-

Course description (Syllabus): This course treats the following issues: Construction, pre-dimensioning and verification of beam sections; Adapting beam section to stress variation; Construction and calculation of the joints of beams; Construction and calculation of truss bridge elements and structures; Orthoprophic plates.â

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges II - Project	PMP08	2	-	-	-	2

Course description (Syllabus): This project treats the following issues: Construction, pre-dimensioning and verification of beam sections; Adapting beam section to stress variation; Construction and calculation of the joints of beams; Construction and calculation of truss bridge elements and structures; Orthoprophic plates.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads III	DRU08	2	2	-	-	-

Course description (Syllabus): The main objective of the course is learning competences related to road superstructure. There are presented elements which define the composition and sizing of different types of road structures, as well as aspects regarding the quality of materials of the layers of the superstructure of modern roads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads III - Project	DRUP08	2	-	-	-	2

Project description (Syllabus): The main objective of the project is learning competences related to road superstructure. There are studied elements which define the composition and sizing of different types of road structures, as well as aspects regarding the quality of materials of the layers of the superstructure of modern roads.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Maintenance and rehabilitation of roads and railways	IDC08	2	2	-	-	-

Course description (Syllabus): The main objective of this course is to know and understand the main causes that lead to the need to rehabilitate roads and railways. There are presented Ways of rehabilitation, Technologies for rehabilitation, Ways of controlling, tracking and receiving during execution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Maintenance and rehabilitation of concrete bridges	IPB08	2	2	-	-	-

Course description (Syllabus): The main objective of this course is to know and understand the main causes that lead to the need to rehabilitate concrete bridges. There are presented Ways of rehabilitation, Technologies for rehabilitation, Ways of controlling, tracking and receiving during execution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Maintenance and rehabilitation of steel bridges	IPM08	2	2	-	-	-

Course description (Syllabus): The main objective of this course is to know and understand the main causes that lead to the need to rehabilitate steel bridges. There are presented Ways of rehabilitation, Technologies for rehabilitation, Ways of controlling, tracking and receiving during execution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Maintenance and rehabilitation of streets	IST08	2	2	-	-	-

Course description (Syllabus): The main objective of this course is to know and understand the main causes that lead to the need to rehabilitate streets. There are presented Ways of rehabilitation, Technologies for rehabilitation, Ways of controlling, tracking and receiving during execution.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Railways II	CF08	3	3	-	-	-

Course description (Syllabus): This course studies the following issues: Traction of trains; Establishing technical elements for designing new railway lines and rebuilding existing ones; Increasing the capacity of railway lines; Dubbing and electrification of railway lines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Railways II - Project	CFP08	2	-	-	-	2

Project description (Syllabus): This project studies the following issues: Traction of trains; Establishing technical elements for designing new railway lines and rebuilding existing ones; Increasing the capacity of railway lines; Dubbing and electrification of railway lines.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Constructions management	MC08	2	2	-	-	-

Course description (Syllabus): management methods, the content of the economic documentation, the evaluation of the stages of the investment process, the way of monitoring a construction work execution by fulfilling the quality criteria, cost and time. In this respect, there are presented aspects regarding: company management, time management, cost, risk, human resources, supply, construction activity organising, investment process (stages, participants), investment project development phases, public auctions, economic documentation for construction works, prices forming.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Diploma specialised project	EPD08	5	-	-	-	6

Course description (Syllabus): This discipline aims to acquire and deepen the technical knowledge necessary for civil engineering design, starting from the pre-dimensioning of the constructive elements, to the statics and dynamics of the structure analysis, but also to the elaboration of the technical-economic documentation

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice – diploma project completion	PRD08	5	-	-	-	60 hours/sem

Course description (Syllabus): During a 60-hour period, the design and completion of the diploma project is pursued by completing all the steps necessary for the elaboration of such documents, taking into account, of course, the knowledge gained during the four years of study, as well as the requirements of the economic environment.