

Transylvania University of Brasov, Romania

Study program: Railways, Roads and Bridges

Faculty: Civil Engineering

Study period: 4 years

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
Geotechnics	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 bridges	PL05	4	2	1	-	-

Course description (Syllabus): Wood used for bridges: 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-005-03 and Eurocode 5 (Design of timber structures) for different types of actions; types of timber jointing – constructive solutions; principles of making timber framing systems for bridges.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete and prestressed concrete II	BAP05	5	2	2	-	-

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. The 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
Hydrology and hydrogeology	HH05	2	1	1	-	-

Course description (Syllabus): Discussion of the basic physical principles of the water cycle (evaporation, condensation, precipitation, runoff, stream flow, percolation, and groundwater flow), as well as hydrological design relevant applications based on case studies. Topics include: Introduction to the science of hydrology. Basic conservation principles and water balance: Precipitation. Evapotranspiration. Unsaturated flow. Infiltration, Runoff. Methods of measurement in hydrology and data analysis. Catchment hydrologic response to precipitation: runoff generation mechanisms. Hillslope hydrology. Frequency analysis in hydrology. Hydrologic design. Groundwater: Darcy's law, flow nets, and well hydraulics.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Hydraulic	HDR05	2	1	1	-	-

Course description (Syllabus): The objective of this course is to develop an understanding of the application and limits of procedures and techniques that practicing engineers employ in conducting hydraulic design. The topics include concepts and equations that apply to the design or analysis of open channels and conduit for culverts and storm drains, Energy Dissipaters, Bridge, Roadside Channels, Stream Stability at Highway Structures.

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.

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

Project title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reinforced concrete bridges	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.

Project title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads II	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
Fondations	FD 06	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 system suitable foundation is very important and must not to conduct to register of an additional request status in the other structural elements or the ground under foundations. The content of course starting from definition and the role of foundations in structural composition of a construction, hypothesis and models of calculation, general rules of design, followed of presentation, the calculation and composition in detail of shallow and deep foundations. So, are presented aspects regarding the calculation of the ground supporting, the methods of water evacuation, the calculation, sizing and composition of retaining walls, followed of the presentation, the calculation and composition in detail of shallow foundations (rigid, elastic, isolated, continue), 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 applicative works.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fondations	FDP 06	2	-	-	-	3

Project 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 need 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	MEF06	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	2	-	-	-

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 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.

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

Project title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges I	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	-	1	-

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
Railway suprastructures for high velocities	SVM07	3	2	-	1	-

Course description (Syllabus): This course studies the following issues: Establishing technical elements for designing railway lines for high velocities; New concepts in establishing the railway line geometry; Modern methods of dimensioning the elements of superstructures.

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 of road, railway and bridge construction works	ORG07	5	2	-	2	-

Course description (Syllabus): The course contains 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 basic elements regarding the 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.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
The tehcnology of road, railway and bridge construction works	TLC07	5	2	-	2	-

Course description (Syllabus): The course contains elements of tehcnology for executing road and railway infrastructures and superstructures; Tehnologies used in preparing elements for railway construction; Tehnologies used in preparing elements for bridge construction. Tehnologies used in mounting railway and bridge constructions; Tehnologies used at tunnel and underground works.

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
Risk assessment	ER07	2	1	1	-	-

Course description (Syllabus): General knowledge regarding risks. Definition of risks, disasters, hazard, vulnerability and fragility. Identifying risks; Analysis of risks; Social dimensions of natural risks; Management of risks.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Special technologies for railway works	TCF08	3	2	1	-	-

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
Special technologies for road works	TD08	3	2	1	-	-

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
Special technologies for bridge and tunnel works	TP08	3	2	1	-	-

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, technology of underground works.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Steel bridges II	PM08	3	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.

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

Project title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Roads III	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	4	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.

Project title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Railways II	CFP08	2	-	-	-	3

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	4	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	4	-	-	-	4

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	2	-	-	-	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.