CIVIL ENGINEERING

GENERAL RULES

- Total amount of ECTS credits chosen by student for each semester cannot exceed 30 ECTS.
- Learning Agreement changes made at the beginning of each semester should not exceed 10 ECTS credits.
- Student is obliged to make necessary changes in the Learning Agreement in two first weeks of each semester.
- The Faculty Coordinator must be informed about classes taken at other Faculties of LUT.
- Student is obliged to attend classes.

Summary of Civil Engineering subjects offered in English

2016/2017

WINTER SEMESTER				
FIRST-CYCLE STUDIES				
Subject	**code**	**hours**	**ECTS**	**Page**
Descriptive Geometry	IK1	45	5	4
Technical Drawing and CAD	IK2	30	3	5
Structural Mechanics I [E]	IK5	75	5	6
Fundamentals of Bridge Engineering	ISW4a	45	4	7
SECOND-CYCLE STUDIES				
Construction Economics and Estimating [E]	IIST3	60	4	8
Scaffolds	IISK3A	30	2	9
Masonry Structures	IISK4A	30	2	10
Wooden Engineering Constructions	IISK5A	30	2	11
Environmental Protection in Design and Construction of Transport Infrastructure	IISD4A	60	3	12

SUMMER SEMESTER				
FIRST-CYCLE STUDIES				
Subject	**code**	**hours**	**ECTS**	**Page**
Concrete Structures I [E]	IK14	60	5	13
SECOND-CYCLE STUDIES				
Politics of equal of opportunities in practice	IIP1A	60	3	14
Construction project management with regard to the environmental aspects [E]	IIK5A	60	3	16
Chemistry of Construction Materials	IIK6A	45	3	17
BIM in General Construction	IISK1A	75	5	18
Building Materials in Energy-efficient Construction	IIWK3Aa	30	2	19
Technologies in Sustainable Construction	IIWK3Ab	30	2	20
Aerodynamics of Engineering Structures	IIWK4Ab	60	4	21
BIM in Design and Construction of Transport Infrastructure	IISD1A	75	5	22
Aesthetics in Design and Construction of Transport Infrastructures	IISD3A	30	2	23
Road pavements and recycling of materials [E]	IISD6A	45	3	24

Descriptive Geometry – IK1

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 45 (15 + 30)	**ECTS: 5**
SEMESTER: Winter	**CLASS LEVEL:** First-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Fundamental knowledge of planimetry and solid geometry. Basic skills in orthogonal projection.

CONTENTS:

Lecture: Projection methods classification and characteristics. Mongean projection method – representation of a point, line and plane; auxiliary views application; measuring distances and dihedral angles; regular polyhedral and their properties; surfaces of revolution: a sphere, a cylinder and a cone. Roof skeletons and developments. Axonometric pictorials. Topographic projection.

Project: Mongean projection method - measuring distances and dihedral angles. Interpretation of results. Mongean projection method - regular polyhedrals constructions (tetrahedron, cube, octahedron). Surfaces of revolution – planar intersections. Development of roof planes. Axonometric view of an engineering construction. Topographic projection: Earthworks. Interpretation of results. Discussion.

EFFECTS OF EDUCATION PROCESS: To get a knowledge of the fundamentals of technical representation of 3-D objects on a 2-D medium. To get familiar with projection methods and their characteristics. To get familiar with regular polyhedral and surfaces properties. Getting acquainted with the practical skills how to create and read technical documentation. Getting acquainted with the practical skills how to solve different civil engineer problems using geometrical methods.

LITERATURE (OPTIONAL): Górska R. A.: Descriptive geometry. Freshman Level Course Adressed to the Engineering Students. Kraków 2013
Slaby S. M. : Fundamentals of Three Dimensional Descriptive Geometry, Wiley, 1976. PN- EN ISO 5456-1:2002 Technical Drawings - Projection Methods - Part 1: Synopsis. PN -EN ISO 5456-2:2002 Technical Drawings - Projection Methods - Part 2: Orthographic Representations. PN- EN ISO 5456-3:2002 Technical Drawings - Projection Methods - Part 3: Axonometric representations. PN- EN ISO 128-30:2006 General principles of presentation- Part 30: Basic convensions for views

TEACHING METHODS: Lecture and classes using multimedia presentations. “Step by step” drawings. Problem solving (group work and individual work). Discussion.

ASSESSMENT METHODS: Exam. Performing the design exercises. Oral presentation or written essay. Students’ activity.

TEACHER (NAME, EMAIL CONTACT): Ewa Zarzeka-Raczkowska, DSc Eng., e.zarzeka-raczkowska@pollub.pl

Technical Drawing and CAD – IK2

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Laboratory
NUMBER OF HOURS: 30	**ECTS:** 3
SEMESTER: Winter	**CLASS LEVEL:** First-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:
Having a computer skill. Knowledge of the principles of creating technical drawings.

CONTENTS:
Creating and modifying simple and complex graphic objects
Dimensioning and annotating drawings, reading out data
Data exchange, OLE technology
Preparation of technical drawings to printing and publishing

EFFECTS OF EDUCATION PROCESS:
Getting acquainted with the practical skills of standard Auto-CAD use, create and publish two-dimensional drawings for a technical documentation.
Getting acquainted with a skill how to use OLE tools for teamwork.

LITERATURE (OPTIONAL):
Jaskulski A., AutoCAD 2012 /LT2012/WS+. Kurs projektowania parametrycznego i nieparametrycznego 2D i 3D.Wersja polska i angielska, PWN Warszawa, 2011
Pikoń A., AutoCAD 2013 Pierwsze kroki, Helion Gliwice, 2013

TEACHING METHODS:
Multimedia presentations. Individual performance of practical tasks prepared for each issue. Performance of project tasks within the teamwork.

ASSESSMENT METHODS: Credits for individual performed practical tasks. Credits for teamwork performed project task. Control test.

TEACHER (NAME, EMAIL CONTACT): dr inż. Ewa Zarzeka-Raczkowska, e.zarzeka-raczkowska@pollub.pl

Structural Mechanics I – IK5

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 75 (45 + 30)	**ECTS:** 5
SEMESTER: Winter	**CLASS LEVEL:** First-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having a knowledge and skills in mathematics and physics which allow solving engineering problems. Having a knowledge in theoretical mechanics.

CONTENTS:

Lecture: Statically determinate rod systems – influence lines (beams, frames, trusses). Virtual work principle, reciprocity theorems. Calculation of general displacements in statically determinate systems. Analysis of statically indeterminate rod systems with use of force method. Reduction theorems and their application. Calculation of general displacements in statically indeterminate systems. Analysis of ultimate limit state of simple rod elements.

Project: Determination of influence lines in statically determinate systems (beams, trusses). Calculation of general displacements in statically determinate systems (beams, frames, trusses). Static analysis of beams and frames with use of force method. Static analysis of trusses with use of force method.

EFFECTS OF EDUCATION PROCESS:

To get a knowledge of the linear static analysis of the 2D statically determinate and indeterminate rod structures as well as the ultimate limit state analysis of simple statically indeterminate rod systems To get a skill in solving engineering problems connected with linear static analysis of the 2D statically determinate and indeterminate rod systems as well as in the ultimate limit state analysis of simple statically indeterminate rod systems

LITERATURE (OPTIONAL):

Z. Cywiński: Mechanika budowli w zadaniach, PWN, Warszawa 1999.
G. Rakowski i inni: Mechanika Budowli. Ujęcie komputerowe t. I, Arkady, Warszawa.

TEACHING METHODS:

Theoretical bases lectures. Case studies lectures. Multimedia presentations, including theoretical contents. Procedures for solving exercises. Exercises with case studies.

ASSESSMENT METHODS:

Test. Project P1. Defense of project P1. Project P2. Defense of project P2. Project P3. Defense of project P3. Project P4. Defense of project P4.

TEACHER (NAME, EMAIL CONTACT): dr inż. T. Lipecki, t.lipecki@pollub.pl

Fundamentals of Bridge Engineering – ISW4a

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 45 (30 +15)	**ECTS:** 4
SEMESTER: Winter	**CLASS LEVEL:** First-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge of structural mechanics, mathematics, strength of materials. Having knowledge of transport constructions. Having knowledge of the ultimate limit state and serviceability one. Knowledge of bridge standards.

CONTENTS:

Lecture: Types of bridges and superstructures cross-sections in case of road and railway bridges. Bridges' mechanical models and materials used. Loads on bridges, the standard BS-EN 1991-2. Definition of the composite of steel-concrete type structure. Beam composite: steel-concrete, concrete-concrete, stainless-steel (hybrid), steel-glulam. The idea of the integration in bridges. Integration by using various connector types. PN-E 1994-2. The geometrical characteristics of the transformed to steel the composite cross-section. The analysis of actual v. initial configurations in order to determine the redistribution of internal forces on the components of the composite beam - axial force, bending moment, shrinkage, temperature. Newmark-Rżanicyn theory in the case of bending for dimensioning of a bridge girder. Designing of rigid and flexible connectors between members. Delaminating in the interface. The environmental aspects and limitation of aggressive effects fauna and flora in the bridge surrounding in the bridge design and maintenance. The beauty of the bridge construction and its monumental impact.

Project: Architectural and structural assumptions to design of the composite bridge steel-concrete type. Establishing of geometric parameters and the bridge cross-sectional design. Adoption of load models. Lateral distribution of loads, the COURBON method. Static-strength calculations of bridge elements. Graphic part of the bridge - development of technical drawings

EFFECTS OF EDUCATION PROCESS: Gaining general knowledge of composite bridge design. Skills to develop the technology of composite bridges.

LITERATURE:

Bridge Engineering Handbook, W.F. Chen, Lian Duan, Wai-Fah Chen

TEACHING METHODS: Multimedia presentations, including theoretical content. Materials related to the issues discussed, communicated to students. The topics to execute projects by students. Computer programs for editing drawings and calculations perform.

ASSESSMENT METHODS: Students' activity, Design results, Presentation of the paper, Test results, Presence

TEACHER (NAME, EMAIL CONTACT): dr inż. S. Karaś, s.karas@pollub.pl

Construction Economics and Estimating – IIST3

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 60 (30 + 30)	**ECTS:** 4
SEMESTER: Winter	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Basic knowledge in construction project management. Basic skills in project scheduling and estimating. Ability to gather, evaluate and analyse relevant information from published sources.

CONTENTS: Lecture: Introduction to corporate finance and managerial economics: a business principal of operation; financial reports and factor analysis as source of information on a company's standing; accounting vs economic profit, alternative cost; time value of money. Basic techniques of financial and economic assessment of project proposals. Models and methods of planning cost of construction projects at consecutive stages of project development. Building design cost management. Sources of cost data. Life cycle cost of built facilities. Value engineering. Role of construction in the economy. Housing. Economic problems of urbanisation. Sustainable development.
Project: Problem solving: financial reports, factor analysis, depreciation of fixed assets, cost of capital, financial leverage. Interpretation of results. Discussion. Problem solving: methods of financial and economic assessment of projects (simple and discounted methods). Cost-benefit analysis. Risk analysis. Interpretation of results. Discussion. Typical economic decision problems of construction project owners and contractors: modelling and solving. Interpretation of results. Discussion. Analysis of design options with consideration to life cycle cost of the built asset. Option analysis, multicriteria analysis, tools in value engineering. Interpretation of results. Discussion.

EFFECTS OF EDUCATION PROCESS: To get familiar with methods and input for planning and assessing economic and financial effects of decisions taken at consecutive stages of construction project development.

LITERATURE (OPTIONAL): Hendrickson Ch.: Project Management for Construction. Fundamental Concepts for Owners, Engineers, Architects and Builders. Version 2.2 . Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, 2008 http://pmbook.ce.cmu.edu/

TEACHING METHODS: Lecture with multimedia presentations. Problem solving (group work and individual work). Discussion.

ASSESSMENT METHODS:

1) financial assessment of a project – individual problem to solve (20%), 2) quantity takeoff for construction works (20%), 3) oral presentation or written essay (20%), 4) field trip report (20%), 5) final test (covers all subjects) (20%)

TEACHER (NAME, EMAIL CONTACT): dr inż. A. Czarnigowska, a.czarnigowska@pollub.pl

Scaffolds – IISK3A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 30 (15 + 15)	**ECTS:** 2
SEMESTER: Winter	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge of structural mechanics and strength of materials. Having a basic knowledge of computational methods applied in building engineering. Having knowledge of steel structures.

CONTENTS: Lecture: Getting to know the definitions and legislation, scaffolds systems and rules of scaffolds design. The overview of the preparation process of scaffolding for the production and marketing. The overview of the scaffolding operating on building sites, including the necessary documentation, rules of erection, exploitation and dismantling. The overview of laboratory tests of scaffolds and methods of statistical analyses of their results. The design of untypical scaffolds. The presentation of implementation of scaffolds.
Laboratory: Assembly of the scaffolds. The creation of scaffold models with using AUTOCAD program. The statics-strength analyses for exemplary scaffolds.
The measurements of strains for facade frame with using Zwick strength machine. The measurements of the bearing capacity for scaffold modular node with using VBai strength machine. The measurements of the bearing capacity for scaffold modular node with using MTS strength machine.

EFFECTS OF EDUCATION PROCESS: Obtaining knowledge of the rules of design and exploitation of scaffolds according to actual standards and law acts. Obtaining knowledge of methods of the technical assessment of scaffold structures and the analysis of their statics work. Gaining the ability to make the statics-strength analysis of scaffold structures.

LITERATURE (OPTIONAL): Zienkiewicz O.C., Taylor R.L., Finite Element Method. Volume 1, McGraw-Hill, London 1989
Podgórski J., Błazik-Borowa E.: The introduction to FEM in statics of structural mechanics, IZT, Lublin 2001
Regulation of the Minister of Infrastructure of 6.02.2003 on health and safety during construction work, Journal of Law 2003, No. 47, item 401

TEACHING METHODS: Multimedia presentations, including theoretical content. Laboratory teaching guidelines. Assembly of the scaffolds. Exercises with the use of computer. Laboratory exercises with the use of strength machine.

ASSESSMENT METHODS: Written test. Active participation measured at each class level of completed tasks. Ranking on the base of the research report and calculations.

TEACHER (NAME, EMAIL CONTACT): Dr hab. inż. Ewa Błazik-Borowa, prof. PL, e.blazik@pollub.pl; mgr inż. Michał Pieńko, m.pienko@pollub.pl

Masonry structures – IISK4A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 30 (15 +15)	**ECTS:** 2
SEMESTER: Winter	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having of knowledge from building materials connected with mortars and masonry elements. Having of knowledge from basics of civil engineering, structural mechanics and strength of materials to solve engineering problems.

CONTENTS:

Lecture: Classes of mortars and masonry elements, masonry strengths. Effective height, reduction coefficients of capacity. Checking of ultimate limit state of masonry pillar in outer wall. Calculations of inner walls on both sides loaded by floor slabs. Calculation models of stiffening walls (horizontally loaded). Reinforced masonry with vertical and horizontal bars (bars in joints). Composite masonry-concrete and masonry-reinforced concrete structures.

Project: Calculation of masonry strength and effective height of walls. Capacity checking of outer wall pillar in selected cross-sections on calculated floors. Capacity of inner walls on both sides loaded by floor slabs. Modelling of stiffening walls and capacity checking with taking into account horizontal load caused by wind.

EFFECTS OF EDUCATION PROCESS:

Getting of knowledge and competences in range of forming and calculation of unreinforced masonry structures. Getting of knowledge and competences in range of forming and calculation of reinforced masonry structures.

LITERATURE (OPTIONAL):

C. Beall, R. Jaffe – Concrete and Masonry Databook, McGraw-Hill 2003,
A. W. Hendry, B. P. Sinha, S. R. Davies, Design of Masonry Structures, Chapman & Hall 2004

TEACHING METHODS:

Multimedia presentations with theoretical content. Sets of tasks prepared for individual calculation elements of project. Project topics for independent executions by students.

ASSESSMENT METHODS:

Written assessment of lectures. Execution of project task. Discussion about solving project task. Written exam.

TEACHER (NAME, EMAIL CONTACT): dr inż. M. Grabias, m.grabias@pollub.pl

Wooden Engineering Constructions – IISK5A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 30 (15 +15)	**ECTS:** 2
SEMESTER: Winter	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:
Knowledge and skills in the field of Structural Mechanics allowing for solving engineering problems. Knowledge and skills in the field of Strength of Materials allowing for solving engineering problems.

CONTENTS:
Lecture: Properties of wood as a construction material. Traditional and modern solid wood constructions. Manufacture of glued laminate wood and its application in engineering structures. Joints of the wooden elements. Methods of checking of the limit states conditions applied to the wooden structures. Protection of the wooden structures against biological corrosion and against fire.
Project: The calculations of the wooden element in terms of the ultimate and serviceability limit state on the example of composite double T beam with nailed joints, selecting mechanical fasteners, protecting against biological corrosion. Making of construction drawings. Shaping the cross section and calculating of the glued laminated element.

EFFECTS OF EDUCATION PROCESS:
Obtaining knowledge about the structural properties of wood, applications of wood in structures and methods of their shaping. Obtaining skills in solving specific engineering problems arising in the designing of complex wooden structures.

LITERATURE (OPTIONAL):
Breyer D.E., Fridley K.J., Cobeen K.E. Design of wood structures, 1999
Kermani A., Structural timber design, 1999

TEACHING METHODS:
Multimedia presentations of lecture content. Individual preparing of the project by a student. Oral answers about the project.

ASSESSMENT METHODS: Final test and evaluation of the correctness of individual exercises

TEACHER (NAME, EMAIL CONTACT): dr inż. J. Szerafin, j.szerafin@pollub.pl

Environmental Protection in Design and Construction of Transport Infrastructure – IISD4A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory + Project
NUMBER OF HOURS: 60 (30 + 15 + 15)	**ECTS:** 3
SEMESTER: Winter	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having basic knowledge about roads and bridges designing and European legislation in environmental protection.

CONTENTS: Lecture: European and national legislation in environment protection. Definitions, scope, aims and rules of environment protection in transport infrastructure. Authorities and institutions of the environment protection. Positive and negative impacts in transport infrastructure. Environment protection against road noise and vibrations. Air, water protection and wastewater management. Soil protection. Waste management and land area's protection. Landscape, land and mineral resources' protection. Nature protection, including forms of nature's protection. Environmental compensations. Monument and archeological sites and cultural property protection. Impact of transport on people's health. Cumulated impacts. Reduced impact area.

EFFECTS OF EDUCATION PROCESS: Gaining basic knowledge about environment protection in transport infrastructure, aims of environment protection and rules of environment protection in transport infrastructure. Gaining basic knowledge about European and national legislation in environment protection in transport infrastructure. Gaining basic knowledge in the scope of environment protection in transport infrastructure for particular resource of the environment. Gaining basic knowledge about negative impact of transport influence on health of people and environment protection methods as well as negative impact of transport infrastructure on people. Gaining basic knowledge about cumulated impacts. Obtaining basic skills in the scope of performing road noise measurements. Gaining basic knowledge in the scope of analysis and designing the protection against negative impact of transport infrastructure on the environment and health of people.

LITERATURE (OPTIONAL): Bohatkiewicz J., Adamczyk J., Tracz M., Kokowski A. I in. Podręcznik dobrych praktyk wykonywania opracowań środowiskowych dla dróg krajowych. GDDKiA. Warszawa, 2008.

TEACHING METHODS: Informative lectures. Practical lectures. Multimedia presentations, including theoretical content. Analysis and design of devices for environment protection. Road noise measurements. Exercise with the use of computer.

ASSESSMENT METHODS: Written exam – theoretical part. Projects - completed tasks. Laboratory - active participation measured at each class level of completed tasks.

TEACHER (NAME, EMAIL CONTACT): dr inż. Janusz Bohatkiewicz, j.bohatkiewicz@pollub.pl

Concrete Structures I – IK14

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 60 (30 + 30)	**ECTS:** 5
SEMESTER: Summer	**CLASS LEVEL:** First-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:
Knowledge about actions. Knowledge about mechanics. Ability of making constructional drawings.

CONTENTS:
Lecture: Characteristic of concrete and reinforced concrete structures work under loading. Concrete properties – strength, deformation under loading, rheology Reinforcing steel– strength, deformation. Bond between concrete and reinforcement. Ultimate limit states. Serviceability limit states. Rules for locating the reinforcement in slabs and beams.
Project: The scheme of structure. The calculation of bending moments and shear forces in slab and beams. Designing the reinforcement in slab and beam. Checking of deflection and cracks width. Rules of performing constructional drawings.

EFFECTS OF EDUCATION PROCESS: Knowledge about designing typical reinforced concrete structures. Ability of designing reinforced concrete slabs and beams.

LITERATURE (OPTIONAL):
EN 1992-1-1:2004, Eurocode 2: Design of concrete structures. Part 1: General rules and rules for buildings. European Committee for Standardization, 2004
Zybura A.: Konstrukcje żelbetowe. Atlas Rysunków. Wydawnictwo Naukowe PWN, Warszawa 2009.

TEACHING METHODS:
power point presentations, tables and constructional drawings, visit in the laboratory

ASSESSMENT METHODS:
Exam. Performing the design exercise

TEACHER (NAME, EMAIL CONTACT): dr inż. M. Grabias, m.grabias@pollub.pl

Politics of equal of opportunities in practice – IIP1A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 60 (30 + 30)	**ECTS:** 3
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Ability to communicate effectively in English at a basic level. Some experience with working in a group. Students are conscious of changes in modern society and increase multicultural.

CONTENTS:

Lecture:

- Nature and features of teamwork: numbers of members, shared goals, cooperation, splitting tasks, abilities and cooperation. Assignment of roles according to abilities and other differences. How to maintain and develop the team. Team motivation: sources of motivation (internal and external), role of leader in motivation. Competition or cooperation? Why cooperation is more effective than competition.
- The climate in an organization authoritarian, bureaucratic, friendly, and innovative. Changes in an organization how to introduce and make changes in the company. Team effectiveness and barriers to effectiveness. Methods of stimulating team work effectiveness: "brainstorming" and "crushing the object" Question check-lists, "Fish-bone diagram" Pareto Chart“, participation.
- Material and non-material aspects of culture: values and norms, diversity of culture (subcultures), ethnocentrism. Socialization: social role and identity (social and individual). Cultural and biological features of gender. Socialization for gender identity and gender roles. Types of femininity and masculinity. Social formation of gender. Homosexuality and attitudes toward homosexuals. Law and the campaign for gay rights.
- Stereotypes and stereotyping: prejudice. Formation and development of stereotypes: what is social stereotype, mechanisms in the development of stereotypes.
- Stereotype and prejudices: External appearance as a basis of stereotyping: e.g. stereotypes of sex, weight, height, nationality, race, and criminality. What to do when I am stereotyped?
- Stereotypes of women and stereotypes of men. Consequences of stereotypes of sex.
- Women’s rights in modern world. Opinions and facts regarding gender equality in Europe. Data on the comparative earnings of men and women. The principle of equal standard of living of both spouses in Polish law. Women working in precarious jobs. Women’s work in the era of globalization- selected issues.
- The basics of the psychology of communication: the perception of people, their acceptance and approval, listening to somebody or pretending to listen to somebody; structure of a simple sentence, e.g., four ways of perception and four meanings of sentences.
- The hierarchy of the needs of people; barriers to communications and how to break them down.

- The cultural differences in non-verbal communication; Non-verbal communication: gesture of possession, gesture of love, power of smile, types of shaking hands, personal space.
- Manipulation: what is it? Types of manipulation: social, emotional, and intellectual. Techniques of persuasion. Ethical and psychological aspects of manipulation. Ways to guard against manipulation.
- Solving a problem using the Gordon Method; Introducing the Gordon Method by giving examples and some practical solutions.
- Conformity: Factors influencing conformity. Psychological reactions to external authority. Stanley Milgram's experiment as a case study in obedience.
- Stanford Prison Experiment, documentary movie "Quiet Rage" of the experiment done by Philip Zimbardo. How situational and individual factors influence our decisions.

EFFECTS OF EDUCATION PROCESS:
To acquaint students with the basic principles of human management and teamwork. To raise awareness of social inequality and sensitivity to effects of stereotypes and prejudice. To acquaint students with the basic ideas of psychology of communication and utilizing them with teamwork

LITERATURE (OPTIONAL):
Ambrosewicz-Jacobs J. Tolerancja. Jak uczyć siebie i innych. Willa Decjusza, Kraków, 2004.
Gidens A. Socjologia. Wydawnictwo Naukowe PWN, Warszawa, 2006.
Macrae, C.N., Stangor, Ch., Hewstone, M. Stereotypy i uprzedzenia. Gdańskie Wydawnictwo Psychologiczne. Gdańsk, 1999.
Kożusznik B. Psychologia zespołu pracowniczego. Doskonalenie efektywności. Wydawnictwo Uniwersytetu Śląskiego, Katowice, 1998.
Sujak. E. ABC psychologii komunikacji. Wydawnictwo WAM, Kraków, 2006.

TEACHING METHODS:
Traditional lecture and class discussion conducted by teacher: Lecture with questions given by teacher to stimulate discussion and multimedia presentation
Laboratory: methods of practice: problem – problem in a team and individually, filling in questionnaires, role-playing, brainstorming in small groups

ASSESSMENT METHODS: Grades from oral activities and participation Grading activities during classes and grading oral answers. Attendance.

TEACHER (NAME, EMAIL CONTACT): Dr Anna Szafranek, a.szafranek@pollub.pl

Construction project management with regard to the environmental aspects – IIK5A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 60 (30 + 30)	**ECTS:** 3
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:
Completed courses in construction technology, construction methods, construction planning and management, and construction documentation. Ability to prepare construction cost estimates. Computer skills: text editing, technical drawing, engineering calculations.

CONTENTS:
Lecture: Introduction to project management in construction. Project management methodology. Basics of decision theory and decision support methods Decision problems in managing construction projects. Risk management in construction. Ecological issues in construction project management.
Project: Scheduling construction project with various conditions and constraints (e.g. limited availability of resources, random process durations).

EFFECTS OF EDUCATION PROCESS:
To provide the student with understanding of project management methodology.
To develop the learners understanding of typical decision problems and suitable decision support methods in managing project.
To introduce the concept of risk management.
To raise student awareness on the environmental impact of construction and civil engineering projects.

LITERATURE (OPTIONAL):
Walker A., Project management in construction, Blackwell Publishing, 2007
Code of practice for project management for construction and development. Chartered Institute of Building, Wiley-Blackwell, 2014
Smith N.J., Merna T., Jobling P., Managing Risk in Construction Projects, Wiley Blackwell, 2014

TEACHING METHODS:
Multimedia presentations, including theoretical content. Project.

ASSESSMENT METHODS: Exam. Project (delivery of complete work). Project defence and correctness of design solutions.

TEACHER (NAME, EMAIL CONTACT): Dr inż. Agata Czarnigowska, a.czarnigowska@pollub.pl

Chemistry of Construction Materials – IIK6A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 45 (30 + 15)	**ECTS:** 3
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having basic knowledge in chemistry and the ability to understand the basic physicochemical changes in construction materials.

CONTENTS:

Lecture: Structure of matter. Construction of solid-body lattice, crystal systems, crystal lattice defects, the binding of atoms in the crystal, glass, ceramics. Chemical bonds and types of building materials- cohesive forces. Mineral chemistry building materials, adhesive-bonding materials. Components and properties of concrete. Introduction to the Chemistry of silicates, organosilicon compounds, the structure and chemical composition of materials. Physical chemistry of water and processes of chemical technology for natural water treatment, the effect of water quality in engineering materials. Chemistry of polymeric materials important in construction, modification of polymer materials and their practical application. Corrosion of materials, processes and the environment. Protection against corrosion, security techniques-of mineral materials (sealing of concrete mechanical and chemical) protection of materials, inhibitors. Road materials, asphalt- tarmac. The chemistry of the rock-forming materials and their occurrence. Physicochemical methods of materials. Advanced technologies in surface engineering of materials.

EFFECTS OF EDUCATION PROCESS: Understanding the chemical structure and chemical processes in building materials. Gaining knowledge of protection against corrosion of building materials. Gaining the ability to evaluate the suitability of water. Systematic habit of self-education, self-reliance, learning skills, learn new techniques and experimental methods.

LITERATURE (OPTIONAL): W. Kurdowski, Cement and Concrete Chemistry , Springer Science+Busines Media B.V. 2014
Lawrence S. Brown, Thomas A. Holme , Chemistry for Engineering students II Edition, Cengage Learning 2009
J. Jaroszyńska-Wolińska, D.Dziadko, Chemia w laboratorium budownictwa, Wyd. Politechnika Lubelska, Lublin 2011

TEACHING METHODS: Multimedia presentations, including theoretical content. Materials containing instructions and tasks of the problem to the individual experimental tasks. Report for each experimental exercises passed to students in the class for self-development and interpretation of experimental results.

ASSESSMENT METHODS: Written exam on lecture. Laboratory- active participation measured at each class level of completed task. Report on laboratory experiments. Passing theory to experiments.

TEACHER (NAME, EMAIL CONTACT): dr hab. Justyna Jaroszyńska-Wolińska, Prof. PL; j.wolinska@gmail.com

BIM in General Construction – IISK1A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 75 (30 + 45)	**ECTS:** 5
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge and skills of general construction, steel construction and reinforced concrete structures covered by the first-cycle studies. Having knowledge in the field of information technology and practical computer skills

CONTENTS: Lecture: The essence of the BIM technology. Parametric modeling - methodology and the possibilities. Integration and data exchange between applications. Use of BIM in the design and erection of buildings (from the point of view of investor, construction manager, engineer, architect, contractor, subcontractor and manufacturer). Case studies - examples of practical use of BIM technology.
Laboratory: Creating grids and sketches, basic operations on objects. Modeling of steel elements, manually creating connections between them and by components. Modeling of concrete and reinforced concrete elements, manual execution of the reinforcement and by components. Control and model numbering. Creating and editing of drawings: summarized, single component, assembly and formwork. Generating of reports and bills.

EFFECTS OF EDUCATION PROCESS: Gaining knowledge about the possibilities of using BIM technology in the design and erection of buildings. Understanding the possible use of computer programs based on BIM technology for supporting the design of buildings. Gaining the ability to design simple buildings objects with selected computer software compatible with BIM technology.

LITERATURE (OPTIONAL): Szeląg M., Szewczak A., Brzyski P., BIM in General Construction, 2016
Eastman C. et al., BIM Handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons, 2011
Krygiel E., Nies B., Green BIM: Successful sustainable design with building information modeling. Wiley Publishing, 2008
Garber R., BIM design: realizing the creative potential of building information modeling, John Wiley & Sons, 2014

TEACHING METHODS: Multimedia presentations, including theoretical content. Multimedia presentations, including examples of practical applications of discussed issues. Laboratory exercise instruction. Exercises with the use of computer.

ASSESSMENT METHODS: Written assessment of the lecture. The presence and active participation in the laboratory. Assessment tasks performed by the student at the end of the laboratories.

TEACHER (NAME, EMAIL CONTACT): Mgr inż. Maciej Szeląg, maciej.szelag@pollub.pl

Building Materials in Energy-efficient Construction – IIWK3Aa

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 30 (15 + 15)	**ECTS:** 2
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge of physics and chemistry of building materials. Having a basic knowledge of methods applied for selection of building materials for energy-saving construction.

CONTENTS:

Lecture: General ideas on building materials for energy-effective buildings. Key issues and terms. Criteria for selection of building materials for energy-efficient construction. Life Cycle Assessment (LCA) of building materials. Overview of building materials for energy-efficient construction. Building materials for thermal insulation (mineral and natural based composites, polymers, advanced materials, reflective materials). Prefabricated building products. Advanced and smart materials for envelopes. Case studies of application of sustainable building materials in energy-efficient buildings.

Project: Selection of energy-efficient ecological building materials for basic structures of single family house (multiple dwelling house). Determination thermal and energy parameters of basic structure elements of single family houses (multiple dwelling house). Familiarizing with open online tools for LCA of buildings depending on building materials selected (Athena Institute software)

EFFECTS OF EDUCATION PROCESS: Gaining knowledge on the principles of energy efficiency criteria of building materials. Obtaining knowledge on the types and properties of building materials for energy-efficient construction. Gaining the ability to select rationally building materials for energy-efficient construction. Understanding the possible use of computer programs for supporting the Life-Cycle Assessment (LCA) of sustainable building materials.

LITERATURE (OPTIONAL): Materials for Energy Efficiency and Thermal Comfort in Buildings. Edited by:M. Hall, Woodhead Publishing Ltd, 2010, 760 p. Part II. Materials and sustainable technologies: improving energy efficiency and thermal comfort in built environment, pp. 175-504.
Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc, 1996, 292 p.

TEACHING METHODS: Informative lectures. Practical lectures. Multimedia presentations, including theoretical content. Case studies. Exercises with the use of computer.

ASSESSMENT METHODS: Written exam – practical part. Written exam – theoretical part. Project – case studies to solve.

TEACHER (NAME, EMAIL CONTACT): Dr. Eng. Nataliya Lushnikova, nataliya.lushnikova@gmail.com

Technologies in Sustainable Construction – IIWK3Ab

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 30 (15 + 15)	**ECTS:** 2
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Basic knowledge of building physics. Basic knowledge of properties of building materials. Basic knowledge of the methods applied in sustainable construction.

CONTENTS:

Lecture: Key issues concerning sustainable construction: from tradition to innovation and back. Basic technologies applied in sustainable construction. Natural local raw materials and traditional technologies. Recycled and reused products in sustainable construction. Advanced and smart materials and technologies in sustainable construction. Case studies of the application of traditional and advanced technologies in sustainable construction.

Project: Study of sustainable construction technologies for a single family house (or a multi–family house). Selection of a sustainable technological method for constructing a single-family house (or a multi-family house). Familiarization with open online tools for LCA of buildings depending on selected building materials and technologies (Athena Institute software).

EFFECTS OF EDUCATION PROCESS: The student has knowledge of the principles and criteria of sustainable construction, of the basic technologies and basic materials used in sustainable construction. The student can rationally select building materials for sustainable construction, and understands possible uses of different methods and tools, including computer programmes, for estimating the construction's influence on the environment. The student can critically evaluate the results of calculations. The student is aware of the need to raise their professional and personal competences.

LITERATURE (OPTIONAL): Elsayed M. Straw Bale is Future House Building Material. Egypt, 2000.
Spegel R., Meadows D. Green building materials. A guide to product selection and specification. 2nd ed., John Wiley & Sons, 2006, 361p.
Pulaski M.H. (Ed.) The Field Guide for Sustainable Construction. Design-Build Institute of America, 2004,312p.

TEACHING METHODS: Informative lectures with multimedia presentations, including theoretical content. Practical lectures. Case studies. Exercises with the use of computer.

ASSESSMENT METHODS: Written exam – practical part. Written exam – theoretical part. Project – case studies to solve.

TEACHER (NAME, EMAIL CONTACT): Dr. Eng. Nataliya Lushnikova, n.v.lushnikova@nuwm.edu.ua

Aerodynamics of Engineering Structures – IIWK4Ab

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 60 (30 + 30)	**ECTS:** 4
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge and abilities in the field of: structural mechanics, strength of materials, computational methods, computer methods, steel structures, reinforced concrete structures.

CONTENTS:
Lecture: Introduction to wind engineering. Basis of theory of stochastic processes. The characteristics of wind in the atmospheric boundary layer. Flow around bodies with different cross sections. Dynamic impact of wind on structures, aerodynamic phenomena. Wind action on engineering structures in Standards. Similarity criteria and model tests in wind tunnels. Issues of wind comfort. Theoretical basis of Computational Fluid Dynamics. Damping techniques.
Laboratory: Solution to a specific engineering problem, for example: steel or reinforced concrete chimney, high-rise building, the bridge or footbridge, etc. Gathering wind effects according to different Standards, and creating model of a structure in the FEM. Running static, modal and dynamic analyses under considered loads

EFFECTS OF EDUCATION PROCESS: Gaining knowledge about: dynamic characteristics of structures (natural frequencies, mode shapes, damping, impulse response function, transmittance); Wind Engineering and, in particular: the basics of the theory of stochastic processes, characteristics of wind in the atmospheric boundary layer as a random process, the wind flow around bluff-bodies, dynamic wind actions on structures, aerodynamic phenomena, aerodynamic interference, Standards issues related to the wind actions on structures, pedestrians wind comfort, research in wind tunnels and in full scale, similarity criteria, aerodynamic damping, basics of Computational Fluid Dynamics. Gaining the ability to solve engineering problems connected with wind loads on structures

LITERATURE (OPTIONAL): Holmes J.D., Wind Loading of Structures, Taylor & Francis, 2007
Simiu E., Scanlan R.H. Wind effects on structures. Fundamentals and applications to design
Dyrbye C., Hansen S.O., Wind Loads on Structures, Wiley, 1997

TEACHING METHODS: Informative lectures. Practical lectures. Multimedia presentations, including theoretical content and case studies. Teaching laboratory exercises. Exercises with the use of computer.

ASSESSMENT METHODS: Written exam. Laboratory project. Written defense of laboratory project.

TEACHER (NAME, EMAIL CONTACT): Dr. Tomasz Lipecki, t.lipecki@pollub.pl; MSc. Paulina Jamińska, p.jaminska@pollub.pl

BIM in Design and Construction of Transport Infrastructure – IISD1A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory
NUMBER OF HOURS: 75 (30 + 45)	**ECTS:** 5
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having knowledge about Computer Aided Design. Having knowledge about design elements of the transport infrastructure. Having knowledge about impact of transport infrastructure on the environment.

CONTENTS:
Lecture: Definition of BIM, BIM role in investment: buildings and transport infrastructure. Key assumptions of BIM. Standardization and maturity of BIM. Towards a BIM-oriented organization. Project management and BIM. BIM capabilities - from 2D to 7D. Computer systems in BIM - review and application.
Laboratory: Preparation for teamwork on a project transportation infrastructure. Preparation of design elements of the transportation infrastructure for the design in the system 3d. Preparation of design work schedule for each task and project participants. Preparation of BIM design standards. Designing collaborative design elements using BIM system.

EFFECTS OF EDUCATION PROCESS: Gaining knowledge about Building Information Modelling (BIM) in transport infrastructure. Gaining knowledge in the use of BIM by the designer, the contractor and the investor. Knowledge of computer software used in BIM. Gaining the ability to use computer software (BIM) in transport infrastructure. Obtaining teamwork skills in designing transportation infrastructure.

LITERATURE (OPTIONAL):
Task 056 Collaborative Planning & BIM. M4/M5 VisiLean Implementation Report. Highways Agency. May 2013
OpenBIM: http://www.openbim.org/

TEACHING METHODS: Informative and practical lectures. Multimedia presentations, including theoretical content. Teaching laboratory exercises. Exercises with the use of computer.

ASSESSMENT METHODS: Written exam – practical part. Written exam – theoretical part. Laboratory - active participation measured at each class level of completed tasks

TEACHER (NAME, EMAIL CONTACT): dr inż. Janusz Bohatkiewicz, j.bohatkiewicz@pollub.pl; dr inż. Jerzy Kukiełka, jerzy.kukielka@pollub.pl

Aesthetics in Design and Construction of Transport Infrastructures – IISD3A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Project
NUMBER OF HOURS: 30 (15 + 15)	**ECTS:** 2
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Knowing a fundamentals of bridges. Having a basic knowledge of road and rail structures.

CONTENTS:

Lecture: Aesthetic canons in architecture and in bridges. The overview of bridge shaping from ancient to nowadays. Simplicity, harmony, dominant, disharmony, eclecticism, form unity with relation to the bridge mechanics. A. Palladio, E, Malinowski, R. Maillart, S. Calatrava bridges. Main elements and details their role in the whole bridge image. What does it mean the beauty of a bridge structure?. Philosophical, somatic, social and statistical aspects of positive/negative aesthetical impression - de gustibus non est disputandum. The Wasiutyński and Leonhardt analyses of bridge architecture and beauty. The traffic marking and safety, driver comfort and aesthetics. Graffiti as a form of artistic expression on bridges.

Project: Aesthetic assessment of a chosen real bridge. The conceptual study of possible changes in the bridge appearance by means of reshape, colour, arranging the surrounding. Digital or other form of visualization. Public presentation of the results.

EFFECTS OF EDUCATION PROCESS:

Gaining knowledge of aesthetics canons in architecture. Be aware with bridge aesthetics by means of monographs by Wasiutynski Z, and F. Leonhardt. Knowing the aesthetics comfort for traffic users. Obtaining knowledge about visualization techniques for aesthetic design. Gaining the ability to design a bridge/eco-bridge with using aesthetics' tool

LITERATURE (OPTIONAL):

Wasiutynski Z., O architekturze mostów, PWN, 1971. (In Polish)
Leonhardt F., Bridges: Aesthetics and Design, The MIT Press; Bilingual edition, 1984.

TEACHING METHODS: Informative lectures. Practical, field lectures. Multimedia presentations. Field and cameral work on project.

ASSESSMENT METHODS: Written exam – practical part. Written exam – theoretical part. Project - active participation measured at each class level of completed tasks. Project – problem to solve.

TEACHER (NAME, EMAIL CONTACT): Dr. inż. Sławomir Karaś, s.karas@pollub.pl

Road pavements and recycling of materials – IISD6A

FACULTY: Civil Engineering and Architecture	**CLASS TYPE:** Lecture + Laboratory + Project
NUMBER OF HOURS: 45 (15 + 15 +15)	**ECTS:** 3
SEMESTER: Summer	**CLASS LEVEL:** Second-cycle studies
MINIMAL NUMBER OF STUDENTS: 12 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Having a basic knowledge of building materials. Having a basic knowledge and skills in the field of research materials properties.

CONTENTS:

Lecture: Laws and regulations. Types and elements of the pavement structures. Materials (aggregate, binders and mixtures). Methods of designing the pavement structure. Perpetual pavement. Designing flexible, semi-rigid and rigid pavements with the catalogue. Recycling of materials. Mixtures with recycling materials. Maintenance, repairs and rebuilding of road pavement.

Laboratory: Research aggregates properties and determine their categories. Research asphalt properties, determine their types and characteristics in the Bitumen Test Data Chart (BTDC). Preparation of asphalt mixtures samples. Tests of asphalt mixtures samples. Preparation of aggregate mixtures stabilized with hydraulic and asphalt binder. Tests of aggregate mixtures stabilized with hydraulic and asphalt binder.

Project: Designing the composition of asphalt mixtures. Designing aggregate mixtures stabilized with hydraulic binder. Designing aggregate mixtures stabilized with hydraulic and asphalt binder.

EFFECTS OF EDUCATION PROCESS: Gaining knowledge of the basic structures of road pavements (flexible, semi-rigid and rigid). Gaining knowledge of basic of materials used in road surfaces. Obtaining basic knowledge in the field of paving technology. Obtaining basic knowledge about recycling of materials (from metallurgical industry, building constructions, mining etc).

LITERATURE (OPTIONAL): Design Manual for Roads and Bridges, Volume 7 Pavement Design and Maintenance, Section 5 Surfacing and Surfacing Materials, Part 2, Hd 37/99 Bituminous surfacing materials and techniques. Amendment no 1, February 2006

TEACHING METHODS: Informative lectures. Practical lectures. Multimedia presentations, including theoretical content. Teaching laboratory exercises and designing mixtures. Exercises with the use of computer.

ASSESSMENT METHODS: Written exam – practical part. Laboratory - active participation measured at each class level of completed tasks. Project – mixture design.

TEACHER (NAME, EMAIL CONTACT): Dr inż. Jerzy Kukiełka, jerzy.kukielka@pollub.pl