Faculty of Civil and Environmental Engineering

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY
IN SZCZECIN, POLAND

THE OFFER FOR INTERNATIONAL STUDENTS
FOR THE YEAR 2023/2024
FIRST DEGREE

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
1	Advanced Concrete Structures	Piotr Brzozowski	summer	5	60
2	Air Pollution Control	Bogdan Ambrożek	winter/summer	4	60
3	Analysis of Environmental Pollutants	Małgorzata Dzięcioł	winter/summer	4	60
4	Analysis of Investment Efficiency	Agnieszka Siewiera	winter/summer	5	60
5	Basic Concrete Structures	Piotr Brzozowski	winter	5	60
6	Basics of Design of Water Supply and Waste Conveyance Systems	Dorota Stocka	winter/summer	4	60
7	Basic Steel Structures	Małgorzata Abramowicz	winter/summer	6	75
8	Bridge Engineering	Janusz Hołowaty	winter/summer	5.0	60
9	Building Installations	Katarzyna Zwarycz-Makles	summer	3	30
10	Building Physics	Karolina Kurtz-Orecka	winter/summer	4	60
11	Chemistry in Environmental Engineering	Magdalena Janus	winter/summer	2	30
12	Computer-Aided Structural Analysis	Ewa Silicka	winter/summer	3	45
13	Computer drawing and detailing	Piotr Brzozowski	winter/summer	3	30
14	Concrete Technology	Piotr Brzozowski	winter/summer	3	45
15	Construction Cost Estimating	Magdalena Bochenek	winter	2	30
16	Contract Procedures	Agnieszka Siewiera	winter	5.0	60
17	Design of Sustainable Buildings	Karolina Kurtz-Orecka	winter/summer	2	30
18	Design of Water Supply and Waste Conveyance Systems	Dorota Stocka	summer	5.0	60
19	Diploma seminar	Andrzej Pozlewicz	winter/summer	2	30
20	Energy Performance of Buildings	Jarosław Strzałkowski	winter/summer	4	45
21	Engineering Optimization	Bogdan Ambrożek	winter/summer	4	60
22	Environmental Geotechnology	Andrzej Pozlewicz	winter	3.0	30
23	Fluid Mechanics	Robert Mańko	winter/summer	4	45
24	Foundations design II - Deep foundations	Andrzej Pozlewicz	summer	5	60
25	Foundations design I - Shallow foundations	Andrzej Pozlewicz	winter	5	60
26	Fundamentals of Environmental Protection	Małgorzata Dzięcioł	winter/summer	4	60
27	Geoengineering	Andrzej Pozlewicz	winter/summer	3.0	30
28	Heat Sources	Dorota Leciej-Pirczewska	winter	5.0	60
29	Highway Engineering	Janusz Hołowaty	winter/summer	5	75

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
30	Hydrology	Robert Mańko	winter/summer	2	30
31	Industrial Steel Structures	Małgorzata Abramowicz	summer	3.0	30
32	Introduction to Eurocodes	Janusz Hołowaty		3	30
33	Negotiations and Conflict Management	Magdalena Bochenek	summer	3	30
34	Numerical Methods in Engineering	Bogdan Ambrożek	winter/summer	4	60
35	Organization of a Construction Company	Agnieszka Siewiera	winter/summer	2	30
36	Project Management I	Magdalena Bochenek	winter	4	60
37	Project Management II	Magdalena Bochenek	summer	6	60
38	Quality Management Systems	Magdalena Bochenek	winter	5.0	60
39	Railway Engineering	Janusz Hołowaty	winter/summer	5.0	60
40	Roads, streets and junctions	Janusz Hołowaty	winter/summer	5	75
41	Site Management I	Magdalena Bochenek	winter	5.0	60
42	Site Management II	Magdalena Bochenek	summer	3.0	30
43	Soil Mechanics	Andrzej Pozlewicz	winter/summer	4	60
44	Spectroscopic Method in Environmental Engineering	Magdalena Janus	winter/summer	2	30
45	Strength of Materials 1	Hanna Weber	winter/summer	3.0	45
46	Strength of Materials 2	Hanna Weber	winter/summer	5.0	60
47	Sustainable Water Management	Dorota Stocka	winter/summer	3.0	30
48	Technology of Foundation Works	Andrzej Pozlewicz	winter/summer	3.0	30
49	Technology of Steel Structures	Agnieszka Pełka-Sawenko	summer	3	30
50	Theoretical Mechanics	Krzysztof Wierzbicki	winter	4	45
51	Urban Water Engineering	Norbert Laskowski	winter	3	45
52	Water Resources Engineering	Dorota Stocka	winter/summer	3	45

Course title	Advanced Concrete Structures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Piotr Brzozowski	**E-mail address to the person**	Piotr.Brzozowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-33-S	**ECTS points**	5
Semester	summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Advanced knowledge of concrete structural engineering		
Entry requirements	Strength of materials Basic Concrete Structures		
Course contents	Design and detailing of advanced reinforced concrete members: snow and wind actions, stairs, columns, shallow foundations, retaining walls. Standards and codes for concrete structures. Environmental loads. Basic of structural design of reinforced concrete stairs. Basic of structural design of reinforced concrete columns. Basic of structural design of reinforced concrete shallow foundations. Basic of structural design of reinforced concrete retaining walls. Basic of precast concrete. Advanced analysis of bending, shear and compression.		
Assessment methods	lecture design workshop Continuous assessment Project works Written exam		
Recommended readings	1. Fundamentals of prestressed concrete design, PCI, 1991 2. Structural Elements Design Manual, Elsevier, 2009 3. Reinforced Concrete Design, Palgrave, 1999 4. Reinforced Concrete: Mechanics and Design, Pearson, 2009		
Knowledge	Student knows the rules for design of reinforced concrete members subjected to compression. Student knows the rules for constructing reinforced concrete foundations.		
Skills	Student can design complex reinforced concrete components of structures and building.		
Other social competences	The student understands the need for lifelong learning.		

Course title	Air Pollution Control		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Bogdan Ambrożek	**E-mail address to the person**	Bogdan.Ambrozek@zut.edu.pl
Course code (if applicable)	WBiIS-1-39-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students will be able to identify the various types of air pollutants. Students will be able to explain the effects of pollutants on human beings and environment. Students will be able to describe the sources of air pollutants. Students will be able to demonstrate basic knowledge of control technologies preventing air pollution.		
Entry requirements	Fundamentals of chemistry and physics		
Course contents	Analysis of methods used for air pollution control: absorption, adsorption, biofiltration, catalytic destruction, particles capture. Introduction. Basic concepts. Air pollution. Smog in troposphere. Ozone depletion in stratosphere. Acid Rain. Aerosols: deposition and nucleation. Ambient Air Quality and Continuous Emissions Monitoring HAP and VOC Control: Absorption; Adsorption; Biofiltration; Thermal Oxidation; Catalytic Destruction; Condensation; Biofiltration; Membrane Separation. NOx Control. Control of SOx. Particles capture. Particulate Control: Cyclone Design; Design and Application of Wet Scrubbers; Filtration and Baghouses; Electrostatic Precipitators. Estimating cost of air-pollution control systems		
Assessment methods	Lecture illustrated by Power Point presentation and computer simulation Classes illustrated by computer and manual calculations Periodic assessment of student achievement Lecture: written test at the end of the semester Classes: written test		
Recommended readings	1. Gerald R. North, John A. Pyle, Fuqing Zhang, Encyclopedia of Atmospheric Sciences, V1-6, Academic Press, Burlington, 2014 2. Schnelle K.B., Brown C.A., Air pollution control technology handbook, CRC, Boca Raton, 2002 3. Flagan R.C.,, Fundamentals of air pollution engineering, Prentice-Hall, New Jersey, 1988 4. Vallero D.A., Fundamentals of air pollution, Academic Press, Burlington, 2008 5. Peirce J.J., Vesilind P.A., Weiner R.F., Environmental Pollution and Control, Elsevier, Amsterdam, 1997 6. Hill M.K., Understanding Environmental Pollution. A Primer, Cambridge University Press, Cambridge, 2004		
Knowledge	Students will be able to identify the various types of air pollutants.		
Skills	Students will be able to explain the effects of air pollutants on human beings and environment.		
Other social competences	Students will be able to demonstrate basic knowledge of control technologies preventing air pollution.		

Course title	Analysis of Environmental Pollutants		
Level of course	first cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Małgorzata Dzięcioł	**E-mail address to the person**	Malgorzata.Dzieciol@zut.edu.pl
Course code (if applicable)	WBiIS-1-52-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Knowledge and skills related to environmental samples collection and preparation. Knowledge and skills related to application of selected methods of instrumental analysis (chromatographic and spectrophotometric) for analysis of common air, water and soil pollutants.		
Entry requirements	Fundamentals of chemistry.		
Course contents	Collection of air samples by isolation and aspiration techniques. Analysis of selected air pollutans by spectrophotometric and chromatographic methods. Analysis of selected water pollutants by spectrophotometric methods. Extraction techniques of pollutants from soil (Soxhlet Extraction, Ultrasound Assisted Extraction). Analysis of selected soil pollutants by gas chromatography with mass selective detector (GC-MS). Types on environmental pollutants. Selection of proper analysis method. Collection of air, water and soil samples. Techniques of sample preparation for analysis. Chromatographic methods: Gas chromatography (GC), High performance liquid chromatography (HPLC) - fundamentals, instrumentation and application in environmental analysis. Spectrophotometric methods - basics and application in environmental analysis. Automatic methods of analysis in monitoring of environmental pollutants. Problems of trace analysis. Sources of errors in analysis. Validation of analytical procedure. Written test.		
Assessment methods	lecture with presentation discussion laboratory classes consultations evaluation of activity during discussion and laboratory classes lecture - written final test laboratory - evaluation of written reports		
Recommended readings	1. M. Radojević, V.N. Bashkin, Practical Environmental Analysis, Royal Society of Chemistry, 2006, 2nd Edition 2. A. Nigam, R. Gupta, Environmental Analysis Laboratory Handbook, John Wiley & Sons, 2020 3. H.M. McNair, J.M. Miller, N.H. Snow, Basic Gas Chromatography, John Wiley & Sons, 2019, 3rd Edition 4. Snyder L.R., Kirkland J.L., Dolan J.W., Introduction to Modern Liquid Chromatography, Wiley, 2010		
Knowledge	Student will be able to describe different techniques of sample collection and selected instrumental methods applied for analysis of environmental pollutants.		
Skills	Student will be able to apply selected techniques of sampling and sample preparation and perform analysis of popular air, water and soil contaminants by spectrophotometric and chromatographic methods.		
Other social competences	Student will be aware of the responsibility for the results of analyses.		

Course title	Analysis of Investment Efficiency		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Agnieszka Siewiera	**E-mail address to the person**	Agnieszka.Siewiera@zut.edu.pl
Course code (if applicable)	WBiIS-1-37-WS	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Knowledge of techno-economic analysis of the viability of the project (project efficiency, financing options, method of profitability assessment as well as risk evaluation) Student has got the competence to the assess the feasibility of the project		
Entry requirements	general knowledge of economics		
Course contents	case study: Efficiency analysis of the selected project with the risk assessment Financing of construction projects. Public Private Partnership. Financing and project profitability. Costs of capital - capital budgeting. Investment decisions and criteria. Project selection in respect to the limited budget. Projects connected in portfolio - independent, complementary, exclusive. Assessment of project efficiency and business plans. Social costs and advantages. Economical and financial aspects of non-profit project profitability. Analysis of internal and external sources of financing. Loan costs and repayment - financial schedule. identification of the risk - matrix. Project CASH FLOW. Efficiency analysis - static and dynamic methods. K/K analysis. Project risk- types and methods of estimations, protective strategies and tools. Risk analysis: risk matrix, analysis of scenarios, sensitivity analysis		
Assessment methods	lecture, discussion, case study, programming with Excel analysis of the selected project and written exam		
Recommended readings	1. D. Beal, Introducing Corporate Finance, John Wiley & Sons, New York, 2015 2. P. L. Bernstein, A. Damodaran, Investment Management, John Wiley & Sons, New York, 2015 3. A. Damodaran, Investment Valuation, John Wiley & Sons, New York, 2018 4. A. Keown, j. Martin, W. Petty, D. Scott, Financial Management. Principles and applications;, Pearson Education, New Jersey, 2014		
Knowledge	Knowledge of techno-economic analysis of the viability of the project		
Skills	Student has got the competence to the assess the feasibility of the project		
Other social competences	Is aware of professional behavior and compliance with the rules of professional ethics, is able to think and act in an entrepreneurial manner		

Course title	Basic Concrete Structures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Piotr Brzozowski	**E-mail address to the person**	Piotr.Brzozowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-32-W	**ECTS points**	5
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Basic knowledge of concrete structural engineering		
Entry requirements	Strength of materials		
Course contents	Design and detailing of basic reinforced concrete members: load collection, effective length of elements, cover of reinforcement, bending and shear calculations. History of concrete structures Standards and codes for concrete structures Proprieties of concrete and reinforcement Structural fire design of concrete elements Basic of structural design of reinforced concrete (beams and slabs). Fundamentals of bending and shear.		
Assessment methods	Lectures Design workshop Continuous assessment Project works Written exam		
Recommended readings	1. Design of Structural Elements, Spon, 2009 2. Reinforced Concrete Design, Palgrave, 1999 3. Reinforced Concrete: Mechanics and Design, Pearson, 2009 4. Composite Structures of Steel and Concrete, Wiley, 2004		
Knowledge	Student knows and understands the theoretical foundations of reinforced concrete structures.		
Skills	Student is able to design simple elements of reiforced concrete construction.		
Other social competences	The student understands the need for lifelong learning.		

Course title	Basics of Design of Water Supply and Waste Conveyance Systems		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Dorota Stocka	**E-mail address to the person**	Dorota.Stocka@zut.edu.pl
Course code (if applicable)	WBiIS-1-01-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To understand the properties of water and wastewater flows To conceive and design simple water distribution system To conceive and design basic sewage system To conceive and design basic stormwater system		
Entry requirements	Basic hydrology and hydraulics Basic drafting skills - AutoCAD		
Course contents	Applying basic design principles to water supply and sewerage system design. Calculating the water demand and wastewater production. Calculating stormwater runoff. Sizing the basic utility systems. Preparing the basic design of water distributing system and wastewater and stormwater sewerage systems. Sustainable water management Drinking water properties and quality Water supply Water demand Water transmission - conditions, materials, etc Water distribution networks Midterm Waste waters Wastewater sewerage systems Stormwater systems		
Assessment methods	Project preparation with the use of computer applications (Excel, Word, AutoCAD) Obtaining project approval		
Recommended readings	1. AWWA, Sizing Water Service Lines and Meters, AWWA Manual M22, Denver, US, 2004, Second Edition 1. ASCE, Standard Guidelines for the Design of Urban Stormwater Systems, ASCE/EWRI 45-05, ASCE, Reston, Virginia, US, 2006 2. AWWA, PVC Pipe - Design and Installation Manual of Water Supply Practices M23, AWWA, Denver, US, 2002, Second Edition 3. I. Bizier, Paul, Gravity Sanitary Sewer, Design and Construction, ASCE, Reston, Virginia, US, 2007, Second Edition		
Skills	Upon successful completion of this course, the student will be able to: - design simple sanitary sewer and water distribution system in accordance with the local municipal design criteria prepare basic water and sewer plan and profile dwg		

Course title	Basic Steel Structures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Małgorzata Abramowicz	**E-mail address to the person**	Malgorzata.Abramowicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-02-WS	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	5	**Hours per semester**	75
Objectives of the course	To introduce to students the theory and application of analysis and design of steel structures To develop students with an understanding of the behavior and design of steel members and systems To prepare students for the effective use of the latest industry standard formulas, tables, design aids and computer software in the design of steel members		
Entry requirements	Mathematics Load estimation skills Structural analysis capability Shear and moment diagrams obtained from static analysis under the appropriate loads Technical drawing		
Course contents	Design elements of a steel industrial storage building comprising secondary beams, girders, column axially compressed and connections. Introduce the behaviour and design of steel structural members according to the limit states design concept. The behaviour and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and design of connections. Elements axially extended Elements of axial compression The complex states of load of steel Bolted connections Welded joints		
Assessment methods	Information lecture Issue lecture Audio-visual presentation Mark for the design Written exam		
Recommended readings	1. Lam, D., Ang, T-C. and Chiew, S-P, Structural Steelwork: Design to Limit State Theory, Butterworth-Heinemann Ltd. 2. Morris, L. J. & Plum, D. R., Structural Steelwork Design to BS 5950, Prentice Hall, 2nd Edition 3. Gardner, L. and Nethercot, D. A., Designer’s guide to Eurocode 3: Design of steel structures, Thomas Telford Limited, 2005 4. Eurocode 1: Actions on structures 5. Eurocode 3: Design of steel structures		
Knowledge	The student is able to design a simple structures and elements of civil engineering. The student has basic knowledge in civil engineering.		
Skills	Student knows codes and guidelines of designing civil engineering structures and elements. Student knows the rules used in the manufacture of steel structures elements. Student can set up the loading acting on the structure. Student can dimension and design of selected elements and simple steel structures.		
Other social competences	The student will be aware of the responsibility for the reliability of the results obtained		

Course title	Bridge Engineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Janusz Hołowaty	**E-mail address to the person**	Janusz.Holowaty@zut.edu.pl
Course code (if applicable)	WBiA-1-03-WS	**ECTS points**	5.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Understanding bridge structure and their elements. Knowledge of basic rules for desiging of bridge structures. Preparing a simple bridge technical or technological design.		
Entry requirements	Technical drawings, CAD preferable. Elementary structural analysis.		
Course contents	Characteristics of bridges and transportation engineering. Basic terms for bridges. Project work introduction. Determination of bridge cross section. Bridge surfacing. Safety barriers and other safety elements. Connection of a road and a bridge. Shaping of bridge superstructures. Rules for bridge general drawing. Work verification and drawings correction. Basic rules for bridge structural analysis. Types of actions on bridges. Models for live loads. Rules for action combinations for selected bridge memebers. Examples of a load determination. Scope of structual analysis. Rules for internal forces calculation and envelop determination. Rules for infuence line usage. Infuence lines for bending moments and shear forces. Determination of internal forces envelopes (M i V). Structural analysis checking and corrections. Possibility of simplified structural analysis. Rules for dimentioning of reinforced concrete elements in bridge structures. Main and additional reinforcement. Rules for durability of structures and design life. Selection of minimal class of structural concrete. Design of a singly reinforced rectangular section. Design of concrete elements for shear. Qualificfation of section for shear. Calculation of reguired and minimal shear reinforcement. Initial selection of link arrangment in concrete elements. elemencie. Structural requirements for reinforcement. Detailing of reinforcement. Shrinkage and additional reinforcement. Requirements for reinfocement in slab spans. Checking of reinforcment calculation and arrangment. Basic rules for preparing of reinforcement drawing. List of materials. Explanation and corrections to reinforcement drawings. Checking of knowledge and comppetence in project work. Final corrections of structural drawings and project works. Discussion on rabge of knowledge and competence for checking. Examples of concrete bridge construction technologies. Resume of project work and final notes. Course range and basic topics. Recommended literature. Bridge menagment in Poland and over the world. Bridge structures in transportation systems. Types of engineering and bridge structures. Tunnels and subways. Ecological structures in transportation infrastructure. Basic dimentions of bridge structures. Openings and clearances for structures. Structural elements of bridge structures. Bridge accessories. Determination of a road bridge cross section (road & bridge). Selection of bridge structural elements and accessories. Materials in bridge construction. Test No. 1. Summary. Action on bridges - permament, variable and live actions. Live loads on road bridges, railway bridges and pedastrian bridges. Basic rules for action combination, combination schemes. Partial factors for actions. Examples of action combinations for simple structural bridge members. Basics of structural analysis. Rules for determination of internal forces. Calculation example for a one-span bridge. Rules developed for simplified calculations. Dimentionig of conrete and steel sections. Basic rules and examples of section werifications. Basic type of concrete bridges. Basic types of steel bridges. Structural concrete, reinforcement and prestresssing steel in bridges. Basic design parameters of concrete and reinforcement. Test No. 2. Structural system of bridges.		

	Summary. Bridge accessories. Types of bridge bearings. History of bridge construction. Notes and credits for a course.
Assessment methods	Informing lecture Problem lecture Project method Lecture credit. Lecture and project tests Project work execution
Recommended readings	1. Barker R.M., Puckett J.A., Design of Highway Bridges, Wiley, Hoboken, New Jersey, 2007, 2 2. Tonias D.E., Zhao J.J., Bridge Engineering, McGrawHill, New York - Toronto, 2007, 2 3. Troitsky M.S., Planning and Design of Bridges, Wiley, New York - Singapore, 1994
Knowledge	Basic knowledge of bridge engineering and materials used in bridge construction Know the basic standards and structural rules for static analysis.
Skills	Can use basic standards and technical rules apllied to bridges.
Other social competences	Basis for constant learning and care for the high level of executed works.

Course title	Building Installations		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Katarzyna Zwarycz-Makles	**E-mail address to the person**	Katarzyna.Zwarycz-Makles@zut.edu.pl
Course code (if applicable)	WBiIS-1-04-S	**ECTS points**	3
Semester	summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Understanding of the workings of building installation (water supply, sanitary, gas, central heating, domestic water system – cold and tap water), performing of calculations and selection of typical basic installation equipment (pipes dimension, water meter, gas meter, boiler, radiators), making design drawings of water installations		
Entry requirements	Ability to draw in AutoCad		
Course contents	Calculate the water and sewerage installations for single-family house. Calculate the central heating and gas installation for single-family house. Determination of pipe diameters and water / wastewater systems. Calculation of heat transfer coefficient values. Identify the need for central heating, the selection of radiators and heat sources. Implementation of drafting projections and sketches (expansions, isometric). Installation materials: pipes, fittings, connections. Pump characteristics, co-operation with the installation. Water and sanitary installations, the principles of design installation. Thermal comfort of rooms. Heating systems: boilers, radiators, thermostatic valves, heat exchangers and expansion vessels. Heat source: boiler and heat distribution centers, construction requirements. Security sources of heat. Centralized supply of heat. Insulation of heat and cold.		
Assessment methods	Lecture, ppt presentation, workshop, practical design lecture: oral exam		
Recommended readings	1. Panchdhari Ac, Water supply and sanitary installations with building design construction and maintenance, New Age International, 2008 2. Ulrich Fox, Installation techniques in housing, Arkady, 1998 3. Standards:, Installations in buildings, http://www.standardsuk.com, 2011 4. Producer/manufacturer catalogues and instructions of equipment		
Knowledge	Cognition of the rules of design and working of water systems in the housing. Formulate, and solve thermal, fluid engineering problems.		
Skills	Design the fundamental elements of domestic water/sewerage system. Design the fundamental elements of central heating system. Design the main elements of heat source for central heating/tap water system in the single-family housing, Employ computing techniques in comprehensive manner to support the study and solution of water installation design problems. Produce engineering drawings of designed water installations.		
Other social competences	Communicate effectively with written, oral, and visual means in a technical setting. Discuss of contemporary environmental issues. Make effective use of source materials, including literature searches, references.		

Course title	Building Physics		
Level of course	first cycle		
Teaching method	laboratory class / project / lecture		
Person responsible for the course	Karolina Kurtz-Orecka	**E-mail address to the person**	Karolina.Kurtz@zut.edu.pl
Course code (if applicable)	WBiIS-1-05-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Skills to computation of building partitions heat transfer coefficient Skills to computation of linear heat transfer coefficient of thermal bridges Skills to evaluate thermal bridges influence on the energy performance of buildings Skills to evaluate thermal characteristics of building materials and partitions using basic laboratory equipment		
Entry requirements	Knowledge of the fundamentals of the Building Materials Knowledge of the fundamentals of Civil Engineering		
Course contents	Evaluation of building materials and partitions thermal characteristics using basic laboratory equipment Heat transfer coefficient of building partitions with homogenious and inhomogenious layers Thermal and moisture control Computaion of influance of thermal bridges Thermal environment Thermal behavior of buildings Fundamentals of heat transfer through building partitions Thermal and moisture control Building envelope weak points - evaluation of thermal bridges		
Assessment methods	Lecture Project work Demonstration Laboratory work Current evaluation of laboratory work Current evaluation of project work Evaluation test		
Recommended readings	1. Incopera F.P., DeWitt D.P., Bergman T.L., Lavine A.S., Fundamentals of Heat and Mass Transfer - Sixth Edition, John Wiley & Sons, 2007 2. McMullan R., Environmental Science in Building - Fifth edition, Palgrave MacMillan, New York, 2006 3. Smith P.F., Architecture in a Climate of Change - A guide to sustainable design - Second edition, Elsevier Architectural Press, Amsterdam – Boston – Heidelberg – London – New York – Oxford – Paris – San Diego – San Francisco – Singapore – Sydney – Tokyo, 2005 4. EN ISO, EN, ISO Standards		
Knowledge	Basic knowledge of physical behavior of building partitions (heat and mass transfer)		
Skills	Student is able to: compute building partitions of heat transfer coefficient, linear heat transfer coefficient, evaluate thermal bridges influence on the energy performance of buildings, to evaluate thermal characteristics of building materials using basic laboratory equipment		
Other social competences	Student understands importance of proper hydrothermal behavior of building partitions		

Course title	Chemistry in Environmental Engineering		
Level of course	first cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Magdalena Janus	**E-mail address to the person**	Magdalena.Janus@zut.edu.pl
Course code (if applicable)	WBiIS-1-53-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Having knowledge of the basics of chemistry in environmental engineering as well as practical skills in the analysis of cations and anions, volumetric analysis and determination of adsorption isotherms.		
Entry requirements	Basics of general chemistry in the field of secondary school		
Course contents	Cation analysis Anion analysis Volumetric analysis Adsorption at the solid-gas interface Periodic table of elements. Atom's construction. Natural nuclear transformations. Chemical bonds. Chemical reactions Chemical kinetics States of matter and adsorption Electrolytes and colloidal solutions Organic compounds Organic pollutants of anthropogenic origin		
Assessment methods	Lectures Laboratories Passing the laboratories will be based on the performance of all laboratories provided in the plan and the preparation of a report. Passing the materials covered by the lecture program		
Recommended readings	1. C. Baird, Environmental chemistry, New York, 1999 2. J. Ziółkowski, Environmental chemistry and protection, Wydawnictwo Studio Sens, Poznań, 1996 3. C. Sawyer, Chemistry for environmental engineering, McGraw Hill, New York, 1994		
Knowledge	Knowledge of chemistry for environmental engineering		
Skills	The ability to qualitative and quantitative inorganic analysis		
Other social competences	She/he has the competence to work in a team		

Course title	Computer-Aided Structural Analysis		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Ewa Silicka	**E-mail address to the person**	Ewa.Silicka@zut.edu.pl
Course code (if applicable)	WBiIS-1-35-WS	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Acquaintance with popular numerical methods according to static analysis of engineering structures Ability of proper numerical definiton and analysis of engineering structures by commercial systems		
Entry requirements	Passed course of mathematic		
Course contents	Manual of the software Analysis of plate truss with the use of commercial system Analysis of plate frame with the use of commercial system Analysis of space frame with the use of commercial system Matrix Displacement Method Basis of static linear analysis of bars, plates, shells and solids elements by finite element method Test		
Assessment methods	Lectures Laboratory tutorials Mark of the final test Evaluation of the prepared examples of numerical models		
Recommended readings	1. Cook R. D., Malkus D. S., Plesha M. E., Witt R. J., Concepts and Applications of Finite Element Analysis, Wiley, 2002 2. Desei C. S., Abel J. F., Introduction to the Finite Element Method, VNR, New York, 1987 3. Zienkiewicz O. C., The Finite Element Method in Engineering Science, McGraw-Hill, London, 1971		
Knowledge	Student knows and understands algorithms of popular numerical methods in accordance with linear static analysis of engineering structures		
Skills	Student is able to define and analyse simple structures with the use of commercial systems		
Other social competences	Student understands responsibility for the professionally made calculations		

Course title	Computer drawing and detailing		
Level of course	first cycle		
Teaching method	laboratory class		
Person responsible for the course	Piotr Brzozowski	**E-mail address to the person**	Piotr.Brzozowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-41-WS	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Basic knowledge of drawing in CAD environment Structural detailing with use of civil engineering dedicated computer programs		
Entry requirements	Hand drawing		
Course contents	Introduction to basic concepts of numerical methods and preparation of civil engineering drawings. Assessing the actions on elements. Preparation of technical drawings in AutoCAD: steel, wood and reinforced concrete elements. Modeling and performing of numerical calculations using computer programs: steel, wood and reinforced concrete elements.		
Assessment methods	laboratory Continuous assessment Project works		
Recommended readings	1. Programs manuals and tutorials, 2016 2. Design Theory and Methods using CAD/CAE, Elsevier, 2014		
Knowledge	Student: has a basic knowledge of the preparation of technical drawings using AutoCAD. Student has a basic knowledge of use the civil engineering calculation software.		
Skills	Student is able solve simple engineering problems using computer programs.		
Other social competences	The student understands the need for lifelong learning.		

Course title	Concrete Technology		
Level of course	first cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Piotr Brzozowski	**E-mail address to the person**	Piotr.Brzozowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-11-WS	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Getting to know the components of the concrete mix, their characteristics and applicable standards Learning the methods of testing the basic properties of components of concrete mix and hardened concrete Getting to know standard requirements and assumptions for designing concrete composition Acquainting with the basic methods of designing the composition of ordinary concrete Getting to know the basic properties of concrete mix and hardened concrete		
Entry requirements	Completed math course Completed course of basic building materials		
Course contents	Basic tests of Portland cement: determination of setting time, determination of compressive and flexural strength Basic tests of aggregate, determination of grain composition Design of aggregate mix Concrete recipe development using the method of three equations Preparation of the concrete mix according to the designed composition, Testing the consistency of the concrete mix using standardmethods, preparation of samples for compressive strength tests. Designing the composition of the concrete mix by the experimental methods Concrete compressive strength testing and determination of concrete strength class Introduction to concrete technology, historical outline, concrete classification Cements: classification, standards, cement hydration, special cements Aggregates: types of aggregates, standard requirements, grain size composition, design of aggregate mixes Mixing water: standard requirements, water demand for concrete components, consistency equation, water in the aggregates Properties of concrete mix, consistency classes, methods of consistency testing. Compressive strength of concrete, concrete strength classes Durability of concrete, exposure classes Designing of ordinary concrete composition: technological conditions, assumptions, selection of components, three equation method Mineral additives for concrete Chemical admixtures for concrete, classification, properties Technological processes of concrete mixing. Mechanical properties of concrete: tensile strength, modulus of elasticity, deformation Introduction to new generation concretes: classification, characteristics		
Assessment methods	Lectures Laboratory works Continuous assessment Written test		
Recommended readings	1. M. Neville A., Brooks J.J., Concrete Technology, 2010 2. M.S. Shetty, Concrete Technology Theory and Practice, 2006 3. M.L. Gambhir, Concrete Technology: Theory and Practice, 2017 4. John Newman, Ban Seng Choo, Advanced Concrete Technology - Set of books, 2003		
Knowledge	Student has a basic knowledge of the required standard tests for the properties of cements, aggregates, mineral additives, chemical admixtures, concrete mix and hardened concrete. Knows the basics of designing concrete mixes, principles of selecting components		
Skills	Can independently and collectively carry out tests on the properties of cements, aggregates, mortars and concrete and evaluate the fulfillment of standard requirements. Is able to design the composition of a concrete mix selecting the appropriate materials for a given structure.		
Other social competences	Student is ready to independently conduct tests on the properties of cements, aggregates, mortars and concrete and evaluate the standard requirements.		

Course title	Construction Cost Estimating		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-43-W	**ECTS points**	2
Semester	winter	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Upon completion of this course the student will be able to comprehend techniques of estimating covered include quantity take-off, labour productivity, and cost of labour, material, and equipment		
Entry requirements	Basic knowledge of construction technology and construction materials		
Course contents	Read and interpret the drawings and specifications Perform quantity takeoffs based on the drawings and specifications and generate detailed estimates Prepare quantity take off of excavation and back-fill Prepare a quantity take off of concrete, and formwork Prepare quantity take off of masonry and finishes Direct and indirect construction costs Use computer to assist in quantity takeoffs Introduction to construction cost estimating The role of estimating in the construction Different types of estimates and their uses Cost estimating techniques Direct and indirect construction costs Labour productivity and labour hours Quantity take-off for materials, labour and equipment cost		
Assessment methods	lecture exercises case study written exam		
Recommended readings	1. Pratt D., Fundamentals of Construction estimating, Delmar Cengage, 2011		
Knowledge	Student has the basic knowledge about techniques of estimating, quantity take-off, labour productivity, and cost of labour, material, and equipment.		
Skills	The student should calculate the cost of construction works.		
Other social competences	The student proceed according to the rules of ethics.		

Course title	Contract Procedures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Agnieszka Siewiera	**E-mail address to the person**	Agnieszka.Siewiera@zut.edu.pl
Course code (if applicable)	WBiIS-1-06-W	**ECTS points**	5.0
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Upon completion of this course the student will be able to comprehend techniques of contract procedures		
Entry requirements	Basic knowledge of construction technology and construction materials		
Course contents	Bidding strategy procurement for defined type of private construction contract, Development of Employer`s and Contractor`s risk matrix for defined type of construction contract, Identification of contractor`s scope of duties for defined type of contract, Definition of supervision principles for identified type of contract, Definition of iterim test of works for identified type of contract, Principles of passing tests on works complition for defined type of contract, Development of Contract sample for defined type of contract, Credit of elaboration, Fundamental principles and definitions of construction contract, Bidding specificity in construction depending on private/ public sector, Different types of contract used by private employers, Strategy and optimization of Employer`s risk for different types of construction contracts - examples, Lumpsum contract - metodology of evaluations, Fixed unit price contract- metodology of evaluations, Reimbursable contracts - assessement of works value, Pre-selection contract - the principles of bidder`s assessement, Negociations in private contract procedures, Turn-key contracts - the principles of procurement, Construction contracts with mixed value assessement, Definition of bid- and performance bonds, Definition of different types and conditions of contractor`s insurances, General condition of contract for project management,		
Assessment methods	lecture Continuous project assessment written exam		
Recommended readings	1. John Murdoch, Will Hughes, Construction Contracts Law aud management, Taylor& Francis, London, 2010 2. Seeley Ivor H., Quantity Surveying Practice, MacMillan, London, UK, 1996		
Knowledge	Rozróżnia podstawowe rodzaje kontraktów i sposoby ich rozliczania, identyfikuje podstawowe ryzyka		
Skills	Opracować ofertę przetargową na roboty budowlane,potrafi kalkulować cenę ofertową przedmiotu zamówienia.		
Other social competences	Jest odpowiedzialny za pracę własną oraz całego zespołu, jest świadomy zadań określonych w przygotowaniu dokumentacji przetargowej.		

Course title	Design of Sustainable Buildings		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Karolina Kurtz-Orecka	**E-mail address to the person**	Karolina.Kurtz@zut.edu.pl
Course code (if applicable)	WBiIS-1-07-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Knowledge of main goals of the sustainable development Knowledge of design challenges for a changing climate Skills of finding proper solutions for construction, materials and thermal insulation for buildings situated in different climates Basic knowledge of passive buildings design		
Entry requirements	Knowledge of the fundamentals of the Building materials Knowledge of the fundamentals of the Civil Engineering Knowledge of the fundamentals of the Building installations (optional)		
Course contents	Elements of sustainable building design Building evaluation tests - thermal behavior and air tightness Sustainable development - Science of sustainability Challenges for the building environment Legislation and Regulations in Europe Sustainability – Tools and techniques Design for sustainability – design for a changing climate Design of sustainable buildings Low energy and passive buildings		
Assessment methods	Lecture / Case method Essays Project work Demonstration Project work evaluation Continous assessment Essays evaluation Evaluation test		
Recommended readings	1. Edwards B., Rough Guide to Sustainability - 3rd Edition, RIBA Pablishing, London, 2010 2. Guzowski M., Towards Zero-energy Architecture - New Solar Design, Laurence King Publishing, London, 2010 3. Hegger M., Fuchs M., Stark T., Zeumer M., Energy Manual - Sustainable Architecture - Edition Detail, Birkhäuser, Basel - Boston - Berlin, 2008 4. Jonstone D., Gibson S., Toward a Zero Energy Home - A complete Guide to Energy Self-Sufficiency at Home, The Taunton Press, Newtown, 2010 5. Roaf S., Fuentes M, Thomas S., Ecohouse - A Design Guide, Elsevier Architectural Press, Amsterdam – Boston – Heidelberg – London – New York – Oxford – Paris – San Diego – San Francisco – Singapore – Sydney – Tokyo, 2007 6. Smith P.F., Architecture in a Climate of Change - A guide to sustainable design, Elsevier Architectural Press, Amsterdam – Boston – Heidelberg – London – New York – Oxford – Paris – San Diego – San Francisco – Singapore – Sydney – Tokyo, 2005		
Knowledge	Student has basic knowledge of design challenges for a changing climate Student knows the basic pronciples of design of passive buildings		
Skills	Student can find proper solutions for construction, materials and thermal insulation for building situated in different climate.		
Other social competences	Student understands the need to design buildings in accordance with the idea of sustainable development		

Course title	Design of Water Supply and Waste Conveyance Systems		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Dorota Stocka	**E-mail address to the person**	Dorota.Stocka@zut.edu.pl
Course code (if applicable)	WBiIS-1-08-S	**ECTS points**	5.0
Semester	summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Municipal services - Understanding the principles and design standards Understanding the principles of water distribution, storm and sanitary sewerage systems. Understanding the approval, planning and design processes. Understanding the basic design criteria and hydraulic analysis for sanitary sewers, stormwater and water distribution systems. Preparing a detailed conceptual site servicing plan for a small residential development.		
Entry requirements	Hydrology Hydraulics Technical drawing and AutoCAD		
Course contents	Applying basic design principles to water supply and sewerage systems design. Calculating the water demand and wastewater production. Calculating stormwater runoff. Sizing the basic utility systems. Municipal servicing - requirements for utility alignment, materials and specifications Preparing the detailed designs of water distributing system and sanitary and storm sewerage systems for a residential subdevision layout. Municipal infrastructure - general design and analysis consideration. Overview of municipal servicing standards and design criteria. General requirements for sustainable land development and water management Water demand and supply Water transmission - conditions, elements, materials, fittings, etc Water distribution network design Midterm test Waste waters and severage systems Sewer transmission - conditions, network elements, materials, etc Stormwater systems		
Assessment methods	Lecture Presentations and video movies Project preparation with the use of computer Obtaining grade for project work		
Recommended readings	1. AWWA, Sizing Water Service Lines and Meters, AWWA Manual M22, Denver, US, 2004, Second Edition 2. AWWA, PVC Pipe - Design and Installation Manual of Water Supply Practices M23, AWWA, Denver, US, 2002, Second Edition 3. I. Bizier, Paul, Gravity Sanitary Sewer, Design and Construction, ASCE, Reston, Virginia, US, 2007, Second Edition		
Skills	Upon successful completion of this course, the student will be able to: - design simple storm, sanitary sewer and water distribution system in accordance with the local municipal design criteria - prepare water and sewer plan and profile dwg - describe material and construction specs for W and SS		

Course title	Diploma seminar		
Level of course	first cycle		
Teaching method	thesis seminar		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-50-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	to manage to connect various knowledge from various disciplines within one project based task		
Entry requirements	Knowledge and skills of fundamental disciplines gained during studies		
Course contents	Preparation of realization plan and scope of diploma thesis with taking into consideration requirements of sending university Determination of aim and structure of the thesis, approval of research project, foredesign preparation. Intelectual property law (copyright) Taking advantage of source information, methods of literature searching, using e-books platforms with respect to licence agreements. Using specialistic shareware and licenced software. Presentation of thesis advancing, presentations skills, preliminary linguistic thesis correction, editing, drawings layout, tables content, bibliographical data Discussion on crucial elements of diploma thesis, data analysis, discussion on results of static calculations, proposals of technical solutions, selection of optimum variants Drawing conclusions, design guidelines, summary of calculation part (research), drawings correction, preparation to oral thesis defence. Rules of thesis presentation and defense with respect of sending university.		
Assessment methods	projects method Problem based lecture Practical methods (presentation) Seminar Presentation of assumptions and working plan of the thesis and expected results Presentation of research project results (calculations, drawings) Conclusions drawn out of case studies, estimation so far received results Final mark on the basis of quality of discussion activity and results psesentation		
Recommended readings	1. Gaugh, H. G.,, Scientific Method in Practice, Cambridge University Press, Cambridge, 2003 2. Douglas C. Montgomery, Design and Analysis of Experiments, John Wiley & Sons, Inc., 2013, 8th Edition 4. Literature according to a scope of final thesis suggested by the tutor		
Knowledge	Student knows typical technologies used in structural and material solutions in civil engineering and knows basic trends in building iondustry		
Skills	Student is able to use basic engineering solutions in constructions by means of a computer software, data processing and other sources		
Other social competences	Student is able to extend the professional knowledge, knows basic rules in team work and is able to communicate with a society to present his work		

Course title	Energy Performance of Buildings		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Jarosław Strzałkowski	**E-mail address to the person**	Jaroslaw.Strzalkowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-46-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Skills of choosing energy balance calculation methods for different study buildings Skills of preparing project data (building, systems, use, surroundings, location) Understanding of building energy performance results Skills of building energy performance calculation of buildings with simple technical systems		
Entry requirements	Knowledge of the fundamentals of Building Materials Knowledge of the fundamentals of Civil Engineering Knowledge of the fundamentals of Building Physics		
Course contents	Energy performance of buildings - Calculation of energy use for space heating and cooling for residential buildings / Charakterystyka energetyczna budynków - Obliczanie zużycia energii do ogrzewania i chłodzenia budynków mieszkalnych Development of energy demand in buildings / Kształtowanie zapotrzebowania na energię w budynkach Characteristics of low-energy buildings, passive houses, use of modern insulation materials and construction of building components, shape factor / Charakterystyka budynków niskoenergetycznych, budynki pasywne, zastosowanie nowoczesnych materiałów izolacyjnych i budowa przegród budowlanych, współczynnik kształtu Building airtightness / Szczelność powietrzna budynku Possibilities of decrease energy demand in existing buildings / Możliwości zmniejszenia zapotrzebowania na energię w istniejących budynkach Windows / Okna Problems related to moisture in buildings / Zagadnienia związane z wilgocią w budynkach Building thermography / Termowizja w budownictwie Thermal bridges / Mostki termiczne Test / Zaliczenie		
Assessment methods	Lectures Case method Project method Test or current rating during classes Final test		
Recommended readings	1. Hegger, Fuchs, Stark, Zeumer, Energy Manual. Sustainable Architecture, Birkhaeuser Basel - Boston - Berlin, Munich, 2008 2. Edawrds B., Rough Guide to Sustainability, RIBA Publishing, London, 2010, 3rd Edition		
Knowledge	Understanding of building energy performance results		
Skills	Skills of choosing energy balance calculation methods for different study building. Student is able to prepare project data, understands building energy performance results, can calculate building energy performance with simple technical systems		
Other social competences	Understanding of importance of building energy performance in modern project design		

Course title	Engineering Optimization		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Bogdan Ambrożek	**E-mail address to the person**	Bogdan.Ambrozek@zut.edu.pl
Course code (if applicable)	WBiIS-1-36-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The student will be able to: 1. Formulate the problem of optimization of engineering systems. 2. Apply optimization algorithms to solve engineering problems. 3. Evaluate the optimization results.		
Entry requirements	Mathematics		
Course contents	Strategies for optimization studies: problem description, model formulation, problem implementation, solution evaluation (solution validation, sensitivity analysis). Engineering case studies. Introduction to optimization. Classical optimization techniques. Unconstrained optimization. Linear programming. Constrained optimization. Geometric programming. Nonlinear optimization. Iterative Solution Algorithms. Multiobjective Optimization. Dynamic Programming. Practical Aspects of Optimization.		
Assessment methods	Lecture illustrated by Power Point presentation and computer simulation Classes illustrated by computer calculations Periodic assessment of student achievement Lecture: written test at the end of the semester Classes: written test		
Recommended readings	1. Belegundu A.D., Chandrupatla T.R., Optimization Concepts and Applications in Engineering, Cambridge University Press, Cambridge, 2011 2. Rao S.S., Engineering Optimization, Wiley, Hoboken, 2009 3. Sioshansi R., Conejo A.J., Optimization in Engineering. Models and Algorithms, Springer, 2017 4. Ravindran A., Ragsdell K.M., Reklaitis G.V., Engineering Optimization: Methods and Applications., Wiley, Hoboken, 2006		
Knowledge	The student will be able to formulate the problem of optimization of engineering systems.		
Skills	The student will be able to apply optimization algorithms to solve engineering problems.		
Other social competences	The student will be able to evaluate the optimization results.		

Course title	Environmental Geotechnology		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-10-W	**ECTS points**	3.0
Semester	winter	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Understanding rules of interaction between antropogenic materials and soil with the effect of underground water presence Skills in recognition of risks for soil and aquatic environment from civil engineering activity To prepare to work in a team in assgnements and develop skills in presentation and discussion on project results in English		
Entry requirements	Completed course of engineering geology Completed course of soil mechanics Completed course of foundation engineering English language at B2 level		
Course contents	Basic design of a landfill for given geological data with respect to soil - waste interaction. Presentation of team work project on specified item. Geotechnics and the environment, environmental basics. Soil investigation for environmental purposes, sampling. Landfill siting and site investigation. Seepage and groundwater control, grouting. Waste disposal by landfill, clay liners. Geomembranes and composite liners. Contaminated land, brown fields. Waste materials in geotechnical construction. Soil - waste interactions. Groundwater lowering in construction. Effects of groundwater movement on environment. Landsubsidence caused by human activities and natural causes. Slurry walls, cut-off walls, technology, design and construction. Key issues of environmental geotechnology impact on built environment		
Assessment methods	lecture problem oriented lecture method of projects Continuous assessment of team work on the project Project defence, group discussion Oral completion of lectures content		
Recommended readings	1. Hsai-Yang Fang, Ronald C. Chaney, Introduction to Environmental Geotechnology, CRC Press, 2016, 2nd Edition 2. Fang H.-Y., Daniels J. L., Introductory Geotechnical Engineering. An Environmental Perspective, Taylor @ Francis, London, New York, 2006, 1, VIII-122 3. Sarsby R., Environmental Geotechnics, Second Ed., ICE Publishing, London, 2013, II 4. Keller E. A., Environmental Geology, Prentice Hall, New York, 2000, 8 5. Qian X., Koerner R. M., Gray D. H., Geotechnical Aspects of Landfill Design and Construction, Prentice Hall, Upper Saddle River, 2002, 1, VIII-860 6. Sharma H. D., Lewis S. P., Waste Containment Systems, Waste Stabilization, and Landfills: Design and Evaluation, John Wiley @ Sons, New York, Chichester, 1994, 1		
Knowledge	Knows basic codes of practice for technologies used in subsoil improvement in civil engineering Knows basic materials used in geotechnology Knows typical engineering techologies implemented in environmental geotechnology Must have knowledge on impact of given soil improvement technology on environment		
Skills	Student is able to : identify basic threats of geotechnical engineering for the environment, design technical part of a municipal landfill, understand the underground water pollution mechanism, propose technological solutions of soil and water remediation Is able to design elements of waste disposal liners Is able to make use of electronic libraries in range of information searching linked to environmental geotechnology		

	Is skilled with English language communication at B2 level with vocabulary of technical English connected to environmental geotechnology
Other social competences	Understands the impact and results of geotechnical engineering on environment Understands the effects of chosen geotechnical technologies on personal and team safety. Understands a need to transfer the knowledge in environmental geotechnology to the society

Course title	Fluid Mechanics		
Level of course	first cycle		
Teaching method	laboratory class / seminar / lecture		
Person responsible for the course	Robert Mańko	**E-mail address to the person**	Robert.Manko@zut.edu.pl
Course code (if applicable)	WBiIS-1-30-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Understands the principles of static and dynamic Able to solve problems of statics, fluid movement: in pipes under pressure, in open channels and in soil Understands basic hydrological concepts		
Entry requirements	Knowledge of the basics of hydrology and geography		
Course contents	Laboratory introduction Determining the limit number of Reynolds Determination of energy and pressure losses in pipes under pressure Determination of the permeability coefficient Water and sediment transport in open channels Final reports testing Physical properties of liquid Hydrostatic pressure Fluid pressure on flat and any surfaces Uplift. Principle of swimming bodies Flow under pressure Flow in open channels Filtration Physical characteristics of the liquid, hydrostatic pressure Hydrostatic pressure on flat surfaces Hydrostatic pressure on any surfaces General definitions in hydrodynamics. types of flows Reynolds number, hydraulic radius Bernoulli equation Local and length friction losses Water flow and sediment transport in open channels Chezy formula, application Filtration		
Assessment methods	Information lecture Solving tasks from the entire range of hydraulics lectures Introduction, help and explanation of current problems arising during laboratory exercises Knowledge test Completing two tests Checking knowledge about the performed laboratory exercises		
Recommended readings	1. Chow, Ven Te, Open channel hydraulics, McGraw-Hill Book, New York, NY. 680., 1959 2. Chow, Ven Te, Handbook of applied hydrology, McGraw-Hill Book Co., New York, NY., 1964		
Knowledge	Basic knowledge of fluid mechanics		
Skills	Student is able to design/calculate simple water system		
Other social competences	The student understands the need for lifelong learning.		

Course title	Foundations design II - Deep foundations		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-49-S	**ECTS points**	5
Semester	summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To provide knowledge of available technologies used in foundation engineering of structures Formation of presentation skills used in project presentation in the English language To create an ability to understand personal responsibility for team work and results		
Entry requirements	Completed course of engineering geology Completed course of strength of materials Completed course of theoretical mechanics Completed course on basics of foundation engineering English language skills at B2 level		
Course contents	Basic design of axially loaded piles under given loads and construction Selection of foundation type and technology, geotechnical conditions, geotechnical categories Slurry walls, caissons, deep shaft foundations. Pile technology with various geotechnical conditions. Basics of axially loaded pile design. Static and dynamic test loading. Pile types, displacement and nondisplacement piles, actions and design situations, design by calculations (ultimate limit states) according to Eurocode 7 Pile design in cohesive and non-cohesive soils, Meyerhof's coefficient, alpha, betha and lambda method, end bearing capacity, skin friction, negative skin friction Site preparation, foundations construction. Excavation methods, trench excavation, support of excavations, anchoring systems Sheet piling technology, cofferdams, basics of groundwater lowering Pile dimensioning according to Eurocode 7, compressive, tension loading, design of pile groups		
Assessment methods	Lecture Method of projects Continuous assessment of advancing the project Defence of the project and discussion in group Oral completion of the course		
Recommended readings	1. Bowles J. E., Foundation Analysis and Design, McGraw-Hill, 1996, Knovel Release Date 2007-01-02 2. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2007, Knovel Release Date: Aug 5, 2009, Earth Sciences 3. Cernica J. N., Geotechnical Engineering: Foundation Design, John Wiley & Sons, New York, 1995 4. Day R. W., Foundation Engineering Handbook - Design and Construction with the 2006 International Building Code, McGraw-Hill, 2006, Knovel Release Date: 2006-08-09 5. Smith I., Smith's Elements of Soil Mechanics. 8th Edition. Design to Eurokode 7, Blackwell Publishing, Oxford, 2006, 8, VIII-114 6. Tomlinson M. J., Foundation Design and Construction, Prentice Hall, Harlow, 2001, 7 7. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows basic solutions of deep foundations systems and relevant codes of practice Student knows codes and guidelines for design and technology of foundation engineering Student knows principles of foundation engineering of building structures. Student knows typical foundation technologies.		
Skills	Student is able to prepare a geotechnical design of a pile foundation under construction and discuss the chosen technologies Student is able to choose a proper foundation technology relevant to a given subsoil condition. Student is competent in communications skills if description and technology of foundation engineering is concern. The English language competence is at least at B2 level. Student is able to make a proper choice of building materials needed in assumed foundation technology.		
Other social competences	Understands and can implement safety rules in deep foundation works		

Course title	Foundations design I - Shallow foundations		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-48-W	**ECTS points**	5
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Creating a competence in searching data for given design assumtions with making use of e-books libraries and competence in preparation results preparation in English language. Creating ability to design a shallow foundation for simplified geotechnical conditions. Providing knowledge of various types of shallow foundations used in civil engineering structures.		
Entry requirements	Completed course of engineering geology Completed course of strength of materials Completed course of theoretical mechanics English language competence at B2 level Completed course of soil mechanics Completed course of structural mechanics		
Course contents	Basic geotechnical design of shallow foundations (isolated footing, strip foundation). Draft dimensioning by Terzaghi's equations. Final dimensioning according to Eurocode 7, GEO, EQU, SLS states. Calculations and drawings. Technical descrption of the project Types of shallow foundations, geotechnical categories, estimation of subsoil conditions Technology and methods of design, geotechnical design by calculation General failure mechanism, bearing capacity equations. Prandtl's theory, Terzaghi's equations, Meyerhof's equations, inclined load, Hansen's contribution. Effective values. Geotechnical design of a shallow foundation according to Eurocode 7, Annex D. Partial factors for actions, geotechnical parameters, soil resistance. Design approach: DA1, DA2, DA3. Ultimate Limit States in geotechnical design: GEO, STR, EQU, HYD, UPL. Serviceability Limit States. Layered soils and groundwater level in geotechnical design of shallow foundations Basic methods of groundwater lowering in construction. Stress distribution change in soil at phases of construction. Oedometric modulus and effective parameters, settltment of a single foundation. Site preparation, excavation methods. Major problems in compacted fill technology, fills and fill compaction. Soil exchange method Soil reinforcement technologies.		
Assessment methods	Lecture Method of projects Continuous project assessment Presentation and group discussion Oral completion Continuous assessment of project advancing Defence of the project		
Recommended readings	1. Bowles J. E., Foundation Analysis and Design, McGraw-Hill, 1996, Knovel Release Date 2007-01-02 2. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2007, Knovel Release Date: Aug 5, 2009, Earth Sciences 3. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2011, 3rd Edition 4. Cernica J. N., Geotechnical Engineering: Foundation Design, John Wiley & Sons, New York, 1995 5. Das Braja M., Shallow Foundations. Bearing Capacity and Settlement, CRC Press, 2010, 2nd Edition 6. Day R. W., Foundation Engineering Handbook. Design and Construction with the 2006 International Building Code, McGraw-Hill, New York, 2006, Knovel 7. Smith I., Smith's Elements of Soil Mechanics. 8th Edition. Design to Eurokode 7, Blackwell Publishing, Oxford, 2006, 8, VIII-114 8. Tomlinson M. J., Foundation Design and Construction, Prentice Hall, Harlow, 2001, 7, VIII-861 9. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows basic solutions of shallow foundations and subsoil behaviour		
Skills	Student is able to prepare a geotechnical design of a shallow foundation under construction		
Other social competences	Is responsible for own safety and working staff during execution works in foundation engineering		

Course title	Fundamentals of Environmental Protection		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Małgorzata Dzięcioł	**E-mail address to the person**	Malgorzata.Dzieciol@zut.edu.pl
Course code (if applicable)	WBiIS-1-51-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Knowledge about air, water and soil pollutants, their sources and impact on environment. Knowledge and skills related to methods applied in environmental protection, including new strategies and processes used in controlling of environmental pollution.		
Entry requirements	Fundamentals of chemistry.		
Course contents	Environmental pollutans - sources, toxicity, effects, methods of emission control. Selected methods and technologies for environmental protection - devices, application and comparative analysis. Actual global and local problems in environmental protection and possible solving strategies. Basic definitions, concepts and strategies in environmental protection. Sustanaible development, end-of-pipe technologies, cleaner production, circular economy. Global problems connected with environmental pollution. Energy production. Renewable energy sources. Air pollution. Types and sources of air pollutants. Consequences of air pollution: smog, greenhouse effect, ozone depletion, acid rain. Particulate matter control - methods and devices: settling chambers, momentum separators, cyclones, fabric filters, electrostatic precipitators, wet scrubbers. Methods and devices applied for control of gaseous pollutants emission: absorption, adsorption, combustion, catalytic conversion, condensation, biofiltration. Water pollution. Types of sources and main pollutants. Monitoring of water quality. Negative effects of water pollution. Wastewater treatment methods and processes: primary, secondary, tertiary. Activated sludge system. Soil pollution. Main sources of soil contamination. Common pollutants and their impact. Remediation methods of contaminated soil. Strategies for soil protection. Wastes - types, problems and utilization methods. Municipal solid wastes management. Recycling methods. Hazardous wastes types and treatment methods. Written test		
Assessment methods	lecture with presentation discussion seminar individual work with the literature consultations evaluation of activity during discussion and seminar lecture - written final test evaluation of presentations during seminar		
Recommended readings	1. R. M. Harrison, Pollution - Causes, Effects and Control, Royal Society of Chemistry, 2014, 5th Edition 2. M. Kutz (ed.), Handbook of Environmental Engineering, John Wiley & Sons, 2018, 1st Edition 3. S.E. Manahan, Environmental Science and Technology, CRC Taylor & Francis, Boca Raton, London, New York, 2007 4. D. Vallero, Fundamentals of Air Pollution, Elsevier, 2014, 5th Edition		
Knowledge	Student will be able to characterize the main air, water and soil pollutants, indicate their sources and environmental impact. Student will be able to identify and characterize the main methods applied for controlling of air, water and soil pollution.		
Skills	Student will be able to collect and analyze data from the literature and prepare presentation on selected topic related to environmental protection.		
Other social competences	Student will be able to work and cooperate in international team and finish all tasks on time.		

Course title	Geoengineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-12-WS	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Create an abillity to proper use of methods of subsoils modification and improvement with respect to geotechnical conditions and actions. Create competence in searching data, e-books, preparation and presentation of project results and draw the conclusions in English language.		
Entry requirements	Completed course of engineering geology Completed course of strength of materials Completed course of foundation engineering English language skills at B2 level		
Course contents	Basic design of subsoil modification with slope stability and cofferdam design. Purpose and methods of soil improvement technologies for different soil and water conditions. Basic methods of modification of subsoil. Soil densification, shallow and deep soil exchange. Soil consolidation methods. Major problems in compacted fill technology, fills and fill compaction. Soil reinforcement technologies. Sheet piling design and technology, cofferdams, waling construction, cantilever walls, anchored retaining walls. Anchoring systems technology. Grouting technology. Basic methods of groundwater lowering in construction.		
Assessment methods	Lecture Methods of projects Continuous project assessment Presentation and group discussion Oral completion		
Recommended readings	1. Ou Ch-Y, Deep Excavations. Theory and Practice, Taylor & Francis, London/Leiden/New York/Philadelphia/Singapore, 2006 2. Bowles J. E., Foundation Analysis and Design, McGraw-Hill, 1996, Knovel Release Date 2007-01-02 3. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2007, Knovel Release Date: Aug 5, 2009, Earth Sciences 4. Cashman P. M., Preene M., Groundwater Lowering in Construction. A practical guide, Spon Press, London, New York, 2001 5. Cernica J. N., Geotechnical Engineering: Foundation Design, John Wiley & Sons, New York, 1995 6. Kalinski M. E., Soil Mechanics. Laboratory Manual, John Wiley & Sons, Hoboken, New Jersey, 2005, Knovel 7. Smith I., Smith's Elements of Soil Mechanics. 8th Edition. Design to Eurokode 7, Blackwell Publishing, Oxford, 2006, 8, VIII-114 8. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows soil improvement technologies with respect to designed construction		
Skills	Student is able: to propose a proper soil improvement technology for given geotechnical and geological data with respect to load distribution, estimate the effect of underground water lowering for neighbouring constructions		
Other social competences	Is responsable for own safety and staff during geoengineering works		

Course title	Heat Sources		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Dorota Leciej-Pirczewska	**E-mail address to the person**	Dorota.Leciej-Pirczewska@zut.edu.pl
Course code (if applicable)	WBiIS-1-13-W	**ECTS points**	5.0
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Knowledge of central heating station equipment Student has got the competence to central heating station design		
Entry requirements	Thermodynamics, Fluid Mechanics		
Course contents	Project of central heating station Mineral, liquid and gas fuel. Fuel storage and transport. Fuel units and installations selection. Fuel burning. Combustion products Boilers and burners construction. Heat sources rooms. Central heating station’s equipment selection. Thermal stations. Heat distribution networks.		
Assessment methods	Lecture, Project Lecture: oral exam		
Recommended readings	1. Kreider J.F, Handbook of Heating, Ventilation and Air Conditioning		
Knowledge	Knowledge of central heating station equipment		
Skills	Student has got the competence to central heating station design		
Other social competences	Student understands the responsibility for the consequences of engineering activity and its impact on the environment		

Course title	Highway Engineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Janusz Hołowaty	**E-mail address to the person**	Janusz.Holowaty@zut.edu.pl
Course code (if applicable)	WBiIS-1-14-WS	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	5	**Hours per semester**	75
Objectives of the course	Understunding highway structures and their elements. Preparing a simple highway design.		
Entry requirements	Technical drawings, CAD preferable. Geometry.		
Course contents	Range of the course. Recommended liiterature. Rural and urban roads. Typical cross sections of highways. Existing, design and under construction road examples. Basic phisical elements of a highway. Traffic lanes, shoulders, hard shoulders, emargency lanes and central reserves. Right-of-way and its boundary. Additional elements in Right-of-way. Range and requirements for project works. Discription of basic terms and definitions. Introduction to the technical requirements for public roads. Rules for execution of technical drawings. Preliminary determination of crown elements. Materials for a road pavement. Traffic category planning. Selection of road pavement according the pavement catalog. Rules for surface drainges of highways. Cross slopes for carriageways and shoulders. Ditches and canalizations. Rules for normal cross section of a road. Edges of carriageway: widenings and restraints. Checking of drawings and pavement type. Planting and vegetation. Integration with rural landscape. Enviromental barriers. Rules for superelevated road cross section. Selecting the cross slope of a carriageway. Shaping the road cross section. Checking and correction of drawings. Road clearances. Traffic safety devices on highways. Basic rules for developing highway restraint systems for vehicles. Working length of safety barriers. Road side barriers. Localization of safety barriers, starting segments and end segments. Minimal length of safety barriers. Protection barriers. Project work tests. Checking design drawings. Using divided cross sections of highways. Simplified capacity of highways. Summary, final checking of design drawings. Additional safety elements for highways. The course range and basic topics. Recommende literature. Highway administration in Poland and all over the world. Road network in Szczecin and in Western Pomerania. Development of highway network in Poland and over the wold. Rual and ubarban roads. Basic elements of highway planning. Basic elements of a highway in a cross section. Single and dual highways. Normal i superelevated cross section of a highway. Basic materials in highway construction. Aggregates, bitumen and ihydraulic binders. Types of road pavements. Types of asphalt mixures. Highway pavement structures. Materials for pavement coures. Standard solutions from pavement catalogs. Enviroment in highways. Impact of construction and service of highway. Noise quality.		

	Test No. 1. Elements of geometric alignment and design of highways. Selection of a highway cross section to traffic volume. Categories and technical classes of highways. Basic parameters for highway design. Influence of highway elements and their location on the highway capacity. Drainage systems for highways. Surface and subsurface drainge. Protection of water. Engineering structures in highway drainage. Road safety. Basic parameters for safety of road traffic. Influence of road parameters on traffic safety. Travel speed and time of travel. Control systems for traffic Safety system for traffic. Roules for a road side design. Soils in highway engineering. Basic classificafion of soils and their usage. Soil and water condition assessment. Frost heave and weak soils. Basic of highway construction. Subgrade preparation and stabilization. Soils for embarkment construction. Execution of cuttings. Drainage at construction time. Materials for roadbase. Surfacing - materials and constructions. Maintenance of highways. Defects assessment and determination of repair range. Repair of pavements. Winter maintenance of highways. Test No. 2. Basic of highway intersections. Types of roundabouts. Traffic signalization. Summary. History of road construction.
Assessment methods	Information lecture Problem lecture Project method Lecture credit Lecture and project tests Project work execution
Recommended readings	1. Martin Rogers, Highway Engineering, Blackwell, Oxford-Singapore, 2008, Second Edition 2. Roger L. Brockenbrough, Highway Engineering Handbook, McGraw Hill, London-Singapore, 2009, Third Edition 3. Manual for Streets, Thomas Telford, London, 2007
Knowledge	Basic knowledge of highway engineering and material used in highway construction
Skills	Can use basic road material standards and technical requirements.
Other social competences	Obtain the base for permanent learning

Course title	Hydrology		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Robert Mańko	**E-mail address to the person**	Robert.Manko@zut.edu.pl
Course code (if applicable)	WBiIS-1-42-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To provide knowledge on hydrological processes as a basis of water management enterprises		
Entry requirements	Basic knowledge of mathematics and physics with elements of differential and integral calculus		
Course contents	Measurement methods and instruments in the field of hydrometeorology, meteorological information Measurement methods and instruments in the field of surface water hydrology, hydrological information Test of knowledge in the field of methods and measuring instruments Development of output tables with daily hydrological data Development of stages and flows hydrgraphs Development of the water-gauges-relations rating curves Development of the stage-outflow rating curve Development of the runoff coefficient for the catchment area Test of knowledge of hydrological curves Hydrological cycle and processes, water balance Hydrological measurements Precipitation and its characteristics Retention and detention - types, assessment methods Outflow - features, characteristics, hydrological curves Statistics in hydrology, probability curves Sediment transport in alluvial streams, methods of assessment Selected problems of river morphology Final assessment		
Assessment methods	Lectures Seminars Written confirmation of the lectures' content knowledge		
Recommended readings	1. Hydrology Handbook (2nd Edition), ASCE, 1996		
Knowledge	Basic knowledge of hydrological processes		
Skills	Posesses skills of hydrological processes analysis in a catchment as a foundation to water management enterprises		
Other social competences	Understands necessity of further deepening of hydrological knowledge		

Course title	Industrial Steel Structures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Małgorzata Abramowicz	**E-mail address to the person**	Malgorzata.Abramowicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-16-S	**ECTS points**	3.0
Semester	summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The aim of the subject is to familiarize the students with a typical case of structural design in 3D. Doing that the students get the understanding of the designer's role in the total process of investment. The lucture is extended by the desription of other typical industrial objects including also managerial aspects of design and erection./ Celem przedmiotu jest zapoznanie studentów organizacji i zarządzania z klasycznym przypadkiem wymiarowania przestrzennych konstrukcji stalowych. Na przykładzie wykonywanego przez studentów projektu hali przemysłowej studenci nabierają zrozumienia roli projektowania złożonych obiektów budowlanych w całości procesu inwestycyjnego. Wykład uzupełniony jest o opis innych typowych obiektów przemysłowych, także pod kątem organizacji ich projektowania i wznoszenia.		
Entry requirements	Mathematics/ Matematyka Descriptive geometry/ Geometria wykreślna Strength of materials/ Wytrzymałość materiałów Structural mechanics/ Mechanika budowli Basic course of steel structures/ Podstawowy kurs konstrukcji metalowych		
Course contents	Design of a simple industrial building Industrial workshops and halls: anatomy of the structure, loads, cladding, investment process aspects Steel storage tanks Industrial chimneys Trestle bridges		
Assessment methods	Lecture/ Wykład informacyjny Design classes/ Ćwiczenia projektowe Passing the project/ Zaliczenie projektu Passing the lecture/ Zaliczenie wykładu		
Recommended readings	1. Dowling P.J., Knowles P.R., Owens G.W., Structural Steel Design, Butterworths, London 2. Bates W., Design of structural steelwork. Workshop with EOT crane, Constrado, Croydon 3. Łubiński Mieczysław i współaut., Konstrukcje metalowe, cz.II, Arkady, Warszawa, 2004		
Knowledge	W wyniku odbytych zajęć student posiada wiedzę związaną z problemami projektowania złożonych konstrukcji stalowych, gdzie bazując na odpowiednich normach jest w stanie wykonstruować określony obiekt budownictwa przemysłowego (halę) i uwzględnić wpływ przyjętych rozwiązań na jego realizację		
Skills	Student posiada umiejętność zaprojektowania względnie prostej konstrukcji inżynierskiej uwzględniając działające na nią obciążenia i dokonać oceny ze szczególnym uwzględnieniem wpływu stosowanych rozwiązań na proces inwestycyjny As a result of the course the student will hold the knowledge of the problems of designing complex steel structures, where based on the relevant standard is able to design specified object industrial building (hall) and the impact of the solutions adopted for its implementation.		
Other social competences	Dzięki pracy w zespołach o międzynarodowym składzie student nabiera zrozumienia wagi własnych działań w kontekście osiągów zespołu, w którym pracuje		

Course title	Introduction to Eurocodes		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Janusz Hołowaty	**E-mail address to the person**	Janusz.Holowaty@zut.edu.pl
Course code (if applicable)	WBiIS-1-36-WS	**ECTS points**	3
Semester		**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Undestanding of structural Eurocodes. Design of simple structural concrete and steel elements.		
Entry requirements	Building structures. Strength of materials.		
Course contents	Introduction. Codes and standards. Loads and actions Limit state design philosophy. Partial factors for loads. Determing loads and actions Structural analysis of beams Checking of excercises. Design of beams for bending moments. Elastic and plastic stresses in beams Structural materials and their main properties Combination expressions. Example - design loads for simply supported beam Reinforced concrete members Design of beams for bending moments Compression members Checking of projects. Summary The Eurocodes history and program. Basic assumptions. Principles and application rules. Benefits and threats. Key aspects of the Eurocodes. EN 1990: Basis for structural design - general assumptions. Terminology, symbols and conventions. Harmonization of Eurocodes. Eurocode structures. Classification of actions. Verification of actions. Combination of actions for design. Design situations. Limits states. Loadings on structures - dead and variable loads. Use of EN 1991. Traffic loads. Floor load distributions. Load arrangment. Enviromental loads. Types of strucural elements. Loads paths. Simplified analysis of structural members. Design rules for structural members. Design of simple structural members. Introdution to design of engineering structures. Summary.		
Assessment methods	Lecture credit Lecture and excercise tests Excercise practise Lecture credit Lecture and excercise tests Excercise practise		
Recommended readings	1. The Essential Guide to Eurocodes Transition, BSI, London, 2010 2. Draycott T., Bullman P., Structural Elements Design Manual. Working with Eurocodes, BH, Oxford, 2009, 2 3. Araya Ch., Design of Structural Elements, Spon Text, London, 2009, 3		
Knowledge	Basic knowledge of structural Eurocodes, their structural parts and unserstanding of their usege.		

	Elementary usage of Eurocodes in designing of structural concrete and structural steel elements.
Skills	Can use basic parts of Eurocodes
Other social competences	Obtain the basis for further development of Eurocodes

Course title	Negotiations and Conflict Management		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-44-S	**ECTS points**	3
Semester	summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Upon successful completion of this course, the students will be able to identify and employ effective communication, problem-solving, and influence techniques appropriate to a given situation.		
Entry requirements	Basic knowledge of conflict resolution		
Course contents	Practice negotiating with role-playing simulations Develop and execute effective negotiation strategies and tactics for different scenarios Identify and employ effective communication, problem-solving, and influence techniques appropriate to a given situation Introduction and course overview Theory, processes, and practices of negotiation and conflict resolution Negotiation theory – strategies and styles Different types of business negotiations Verbal and nonverbal communication Conflict management and conflict resolution Communication in conflict management Conciliation and mediation Motivation		
Assessment methods	lecture exercise case study written exam		
Recommended readings	1. Zartman W, Negotiation and Conflict Management: Essays on Theory and Practice, Routledge, 2009		
Knowledge	Student has the basic knowledge about effective communication, problem-solving, and influence techniques appropriate to a given situation.		
Skills	The student should be able to negotiate.		
Other social competences	The student proceed according to the rules of ethics.		

Course title	Numerical Methods in Engineering		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Bogdan Ambrożek	**E-mail address to the person**	Bogdan.Ambrozek@zut.edu.pl
Course code (if applicable)	WBiIS-1-38-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The student will be able to: 1. Use of modern computational and numerical techniques in engineering. 2. Understand how the algorithms work and why numerical algorithms sometimes give unexpected results.		
Entry requirements	Mathematics		
Course contents	Solving systems of linear and nonlinear algebraic equations. Solving linear and nonlinear regression problems. Solving ODEs and PDEs. Solving optimization problems. Solving selected engineering problems using numerical methods. Systems of linear algebraic equations. Systems of non-linear algebraic equations. Interpolation and curve fitting. Numerical differentiation. Numerical integration. Eigenvalues and eigenvectors of matrices. Linear and nonlinear regression. Solutions of ODEs: Runge Kutta, multistep methods, Gear’s algorithm, stiffness and stability of algorithms. Solutions of PDEs: finite difference, finite elements, method of lines, shooting methods. Introduction to optimization.		
Assessment methods	Lecture illustrated by Power Point presentation and computer simulation Classes illustrated by computer calculations Periodic assessment of student achievement Lecture: exam at the end of the semester Classes: written test		
Recommended readings	1. Chapra S.C., Canale R.P., Numerical Methods for Engineers, McGraw-Hill, Boston, 1998 2. Rao S.S., Applied Numerical Methods for Engineers and Scientists, Prentice Hall, New Jersey, 1999 3. Rice R.G., Do D.D., Applied mathematics and modeling for chemical engineers, Wiley, New York, 1995 4. Kiusalaas J., Numerical Methods in Engineering with MATLAB, Cambridge University Press, 2005 5. Hicks M.A, Brinkgreve R.B.J., Rohe A., Numerical Methods in Geotechnical Engineering, CRC, 2014		
Knowledge	The student will be able to understand how the numerical algorithms work		
Skills	The student will be able to use computational techniques in engineering.		
Other social competences	The student will be able to use of modern computational and numerical techniques in chemical engineering.		

Course title	Organization of a Construction Company		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Agnieszka Siewiera	**E-mail address to the person**	Agnieszka.Siewiera@zut.edu.pl
Course code (if applicable)	WBiIS-1-55-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Principles of company management. Knowledge of techno-economic analysis of the profitability of the company. Basic knowledge of costs and incomes in company activities in respect to profit management. Student has got the competence to create a company and run a business		
Entry requirements	general knowledge of economics		
Course contents	project of own company: registration, employment plan: organizational chart, financial analysis: calculation of costs / revenues, marketing analysis of the company and its products with the choice of strategy Company management: registration and types of running a business; owners/partners/shareholders and company's bodies: management board and supervisory board; sources of financing for the company and its projects; financial standing of the company: financial statements, profit and loss account - costs and revenues in the company; end of the financial year - profit distribution in the enterprise, taxes; organization of the company: organizational chart - employment; business strategies / marketing analysis: company's product portfolio, market and competition analysis, risk analysis		
Assessment methods	lecture, discussion, case study analysis of the selected project		
Recommended readings	1. T. Barta , P. Barwise, The 12 Powers of a Marketing Leader: How to Succeed by Building Customer and Company Value, London, United States, 2016 2. P. Netscher, Building a Successful Construction Company: The Practical Guide, Createspace Independent Pub, 2014 3. A. Keown, j. Martin, W. PeD. Scott, Financial Management. Principles and applications, Pearson Education, Inc., New Jersey, 2013 4. F. Lawrence, Go to Market Strategy, Taylor & Francis Ltd, 2018 5. D. Gerstel, Running a Successful Construction Company, Taunton, 2012 6. T. C. Schleifer, K. C. Schleifer, Managing the Profitable Construction Business: The Contractor's Guide to Success and Survival Strategies, 2014		
Knowledge	Knowledge of techno-economic analysis of the profitability of the company. Basic knowledge of costs and incomes in company activities in respect to profit management.		
Skills	Student has got the competence to create a company and run a business		
Other social competences	Is aware of professional behavior and compliance with the rules of professional ethics, is able to think and act in an entrepreneurial manner		

Course title	Project Management I		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-17-W	**ECTS points**	4
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student to be familiar with methodologies and principles of decision making by Employer Student to be able to assess a project risk		
Entry requirements	Completed course of company organization Completed course of building Economics and works technology		
Course contents	Identification and analysis of different projects stakeholders, Initial phase - technical and financial analysis of Project, Project selection by the Owner - SWOT and PEST analysis Project brief and objectives, Log-frame matrix in PCM methods of Project Management, Milestone schedulling, Work Breakdown Structure (WBS) of the whole project life cycle, Passing test Basic pronciples and definitions of Project Management, Project Life Cycle - examples of different discyplines, Identification of Project stakeholders and analysis of their influence on Project outcome, Basic conditions and constraints in Management of the Project, Planning of Project strategy - main objectives and Project priorities, SWOT and PEST analysis as the base for Project selection by the Owner, Various models of Project Management - optimization of methodology Methodology of process management by Project Management Institute - PMBOK Project scope management by PMI standards, Project life cycle management according to European Commission standards, Structure and principles of Project log-frame procurement, Indicators of Project objectives achievement - SMART test, The other standards of Project Management - ISO 10 006, BS 6079, Prince 2, AGILE Work Breakdown Structure of the whole project life cycle (WBS),		
Assessment methods	lecture exercises written exam case study		
Recommended readings	1. Kerzner Harold, Project Management - A system approach to planning, scheduling and control, John Wiley &Sons, 2003 2. Project Management Institute, A guide to the Project Management Body of Knowledge", 2000 3. Halpin D.W., Woodhead R.W., “ Construction Management”, John Wiley & Sons, 2011 4. Kerzner Harold, Advanced Project Management, John Wiley &Sons, 2004 5. The Chartered Institute of Building, Code Of Practice For Project Management For Construction and Development, Wiley-Blackwell, 2010 6. Rory Burke, Poject Management, Planning and Control, John Wiley&Sons, 1992 7. Nicholas J.M., Steyn H., Projekt management for business, engineering, and technology. Principles and practice., Elsevier Butterworth Heinemann, 2008		
Knowledge	Rozróżnienia cykl życia projektu inwstycyjnego z podziałem na poszczególne fazy, charaktetyzuje mocne i słabe strony projektu, rozpoznaje główne założenia projektu i metody zrządzania		
Skills	Dobiera modele zarządzania projektem na podstawie kryteriów i wymogów zamawiającego,analizuje ryzyko inwestycji i wykonalność techniczną i finansową.		
Other social competences	Jest świadomy zachowań zgodnych z etyką zawodową oraz jest zorientowanyw działaniach dotyczących przedsiębiorczości.		

Course title	Project Management II		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-18-S	**ECTS points**	6
Semester	summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student to be familiar with organization and comencemment of construction project Student to be familiar with time management of project		
Entry requirements	Completed course of Project Management I Completed course of Site Management I Completed course of Quality Managenebt Systems		
Course contents	Network schedules for the whole life-cycle of the Project, Development of Project Management Plan (PMP) for construction process, Project costs control in the whole life cycle, Calculation of project activities progress by means of Percentage Complete method, Earned Value Method with regards to all stages of Project, Control of project execution, The life cycle of construction Project, Basic functions of Employer in construction process, The principles of time management in various stages of construction process, The principles of Project Management Plan development, Basic concepts and definitions of the Leadership Project team organisation, Responsibility Allocation Matrix (RAM) of Project - trainning, certificates, up-grading, The scope of project technical dokumentation in comparison of execution effectiveness, Trends` analysis of Activities progress with regards to base-line Plan, Financial analysis of project progress during execution stage - Earned Value Method		
Assessment methods	lecture exercises case study written exam		
Recommended readings	1. Kerzner Harold, Project Management - A system approach to planning, scheduling and control, John Wiley &Sons, 2003 2. Kerzner Harold, Advanced Project Management – edycja polska, John Wiley &Sons, 2004 3. Rory Burke, Project management – planning and control, John Wiley &Sons, 1993		
Knowledge	Rozpoznaje potrzeby zasobów niezbędnych do realizacji inwestycji, definiuje i kontrolujekosztybudowy zgodnie z harmonogramem		
Skills	Tworzy zespół do realizacji projektu budowlanego, sporządza harmonogram działań inwestycyjnych.		
Other social competences	Jest świadomy zachowania w sposób profesjonalny, jest zdolny do podejmowania decyzji w zakresie usprawnienia procesu inwestycyjnego.		

Course title	Quality Management Systems		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-19-W	**ECTS points**	5.0
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student to be familiar with quality procedures according to ISO 9001 Student to be able for working-out of Quality Planning		
Entry requirements	Completion of Comprehensive Building course Completion of company organization course		
Course contents	Family of standards ISO-9000 Developing of Quality Policy - examples of different organisations, Quality procedures in accordance with standard ISO 9000 Quality procedures structure in construction company - examples, Construction works Quality Plan Operational Instructions, Quality records, Pareto analysis, Ishikawa diagram Improving of quality - brain storm, comparison in couples, Basic statistic calculations for Quality system - examples Passing test History and evolution of quality concepts - quality standards and their basic description, Classic approach to quality by W.E. Deming, Changes to the approach of quality problems affected by market processes, Quality costs vs. business efficiency of the company, 8 quality principles as the base of management system, Basic tools of quality management – Fishbone diagram, Pareto analysis, statistic methods, Basic principles of total quality management (TQM) in construction, Definitions and principles of standards ISO 9000 Process approach in development of quality system in construction company, Fundamentals of quality assurance system QAS documentation according to ISO 9001 : 2008. Quality Policy of construction company. Procedures and instructions of QAS. Quality records. Lecture test		
Assessment methods	Informative lectures case studies testing of knowledge Tutorials pass		
Recommended readings	1. Flood Robert L., Beyond TQM, John Wiley & Sons, 1994 2. Georg Stephen, Weimerskirch Arnold, Total Quality Management, John Wiley & Sons, 1994 3. joint publication, English for construction managers and engineering. Part 8: Quality management in construction, Poltext, Warszawa, 2009 4. joint publication, ISO 9000:2005 Quality management systems - Fundamentals and vocabulary, 2005 5. joint publication, ISO 9001:2015 Quality management systems - Requirements, 2015 6. joint publication, ISO 9004:2000 Quality management systems- Guidelines for performance improvements, 2004 7. joint publication, ISO 19011:2018 Guidelines for auditing of Quality Management Systems, 2018		
Knowledge	Zna procedury systemu zarządzania jakością robót budowlanych orza plany jakości dla różnych rodzajów robót budowlanych.		
Skills	Potrafi opracować dokumenty systemu zapewnienia jakości w firmie budowlanej		
Other social competences	Jest odpowiedzialny za pracę własną i wspólnie realizowane zadania, ma świadomość profesjonalnego zachowania i przestrzegania etyki zawodowej		

Course title	Railway Engineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Janusz Hołowaty	**E-mail address to the person**	Janusz.Holowaty@zut.edu.pl
Course code (if applicable)	WBiIS-1-20-WS	**ECTS points**	5.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Unsestending railway structures and their elements. Preparing of simple design of a railway line.		
Entry requirements	Technical drawings, CAD preferable. Geometry.		
Course contents	Introdution to project work. Rules for rail instruction and technical requirements. General rules for selecting a track structure elements. Categories of railway lines and their technical parameters. Typical cross sections for single track railway lines. Clearance for railway lines and railway structures. Selection of the ballast type and its depth. Selection of elements for track structure. Types of railway sleepers and their application range. Initial selection of a railway line cross section. Preparing of formation cross section at bank and in cutting. Selection of cross slopes and calculation of levels. Railway track gauge development. Widening of track on curves. Checing and correction of technical drawings. Initial selection of superelevated cross section on horizontal curvature. Cant and widening of track gauge on curves. Extra clearance on curves. Safe speed on curves. Preparing of a superelevated cross section on a horizontal curve. Geometric alignment of railway lines. Minimal redius according category of a railway line. Service parameters for geometry of a railway line. Vertical alignment of railway lines. Minimum and maximum gradients. Minimal radius values for vertical curves. Track and station drainage. Surface and sub-surface drainge. Ditches, draunage pipes and wells, drainage systems. Acceptance of project work. Final correction of technical drawings. Project work summary. Discussion of problems and mistakes. Basic of non-ballasted tracks. Scope of the course, recommended literature. Instructions used in construction and maintenance of railway lines. History and development of the rail transport. Actual condition of railway lines in Poland and over the world. Financining and rail administration. Service parameters of railway lines. Types of rail traffic. Qualification of railway lines: categories and technical classes. Users and menagment of railway lines. General guidance for railway infrastructure planning. Chosing a route and a profile for a railway line. Railway stations. Passenger traffic. Lifts, escalators and pumps. Air conditioning. Platforms, subways and footbridges. History of track construction. Early rails and supporting elements. Clasiffication of track structures - technical classes. Railway track gauges: narrow, standard and broad. Diffrent gauges in different coutries or regions. Basic elements of the track structure. Ballasted and non-ballasted tracks.		

	Materials for ballast. Types of sleepers. Rail sections and characteristic parameters. Type of rail fastenings, baseplates and pads. Rail joints. Functions of sleepers. Subgrade and formation. Slopes of formation. Execution of earthwork in embakments and cutting. Track alignment design parameters. Gradients. Ruling gradients. Pusher or helper gradient. Plain lines. Swiches and crossings. Curves and superelevation. Redius of a horizontal curve. Cant. Cant deficency and excess. Vertical curves. Railway lline cross sections: double track and single track sections. Technical examples. Technology of railwayworks. Building a new track. Rehabilitation and renewal of track. Test. Types of soils and earthwork. Track drainage. Strengthening of soils. Course summary.
Assessment methods	Information lecture Problem lecture Project method Lecture credit Lecture and project tests Project work execution
Recommended readings	1. Clifford F. Bonnett, Practical Railway Engineering, Imperial College Press, London, 2010, 2nd Edition 2. Satish Chandra & M.M. Agarwal, Railway Engineering, Oxford University Press, USA, 2013, 2nd Edition
Knowledge	Basic knowledge of railway engineering and materials used in railway construction
Skills	Can use technical standards for railway engineering
Other social competences	Obtain the basis for development of railway standards and requirements.

Course title	Roads, streets and junctions		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Janusz Hołowaty	**E-mail address to the person**	Janusz.Holowaty@zut.edu.pl
Course code (if applicable)	WBiIS-1-21-WS	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	5	**Hours per semester**	75
Objectives of the course	Understanding the principles of design of roads, streets and junctions		
Entry requirements	Basic civil engineering knowledge. Basic drawing skills in Cad software		
Course contents	Introduction to project work. Project subject Techical parameters of streets Typical and standard street cross sections Examples of streets - design parameters Designing the street cross sections Designing the streets' pavements Basic types of junctions Desining the simple street junction Basic definitions and termss regarding roads, streets and junctions Functions of streets and highways. Basic street functions Categories and technical classes of roads and streets, hierarchcies of movement and components Road and street clearances. Operating spaces Guidelines to street designs Kerbing of streets. Kerbs & Restrains, Edgings. Road kerbs and street kerbs Footways, cycle paths and parkings Street examples. Traditional types of streets Street technical specifications Pavements and pavement's layer Types of junctions Geometry and visibility Drainage of roads and streets Streets: geometry and visibility		
Assessment methods	Lecture Workshop Grade Project work		
Recommended readings	1. Corporate author, A Policy on Geometric Design of Highways and Streets, AASHTO, Washington, 2004 2. Edited by W.F. CHEN, J.Y. Richard Liew, The Civil Engineering Handbook, CRC Press, Boca Raton, London, New York, Washington, D.C., 2003 3. Reinhold Baier et al., Directives for the Design of Urban Roads, RASt 06, FGSV, Cologne, 2006		
Knowledge	Student knows the technical guidelines used in the design of various junctions and intersections. Knows the basic principles of developing and printing road drawings using the CAD software.		
Skills	Student can design a street intersection. Can read surveying maps and construction drawings.		
Other social competences	Understand the responsibility for the consequences of engineering activity and its impact on the environment.		

Course title	Site Management I		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-22-W	**ECTS points**	5.0
Semester	winter	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students to be familiar with preperation and execution process by the Contractor Knowledge of scheduling of construction works Assessement of risk during the executiond of the works		
Entry requirements	Completed course of Construction companies organization Completed course of building Economics		
Course contents	Documents for taking-over of construction site, Organization charts of construction site, Construction Works quantities and time calculations, Developing of barchart, Resource histogram, Development of safety Plan (BIOZ) Building materials` stockyards, Construction site layout, Passing test Legal and contractual aspects of construction works commecement, Procedure of mobilization and taking-over of construction site, Planning and organisation of technical infrastructure on site, Planning of optimal technology of construction works, Identification of detailed scope of works - WBS Scope of duties and responsibilities of key positions of Contractor on site, Safety Plan BiOZ complient with technical and legal requirements, Planning of equipment and human resources necessary for contractual scope of works, Gantt`s chart - key dates of construction works, Line of balance in site human resources histogram, Scope of duties and interpersonal stipulation for site manager,		
Assessment methods	Informative lectures Case studies Testing exam for lectures Tutorials assessement		
Recommended readings	1. Rory Burke, Project Management Planing and Contraction, John Wiley & Sons, 1992 2. Andersson C.A.,Miles D., Neale R., Ward J., Site management. Workbook., Ineternational Labour Office, Geneva, 1996 3. Praca zbiorowa, English for construction managers and engineering. Part 2: Principles of the management in construction., Poltext, Warszawa, 2008 4. Kerzner H., Project Management. A system approach to planning,scheduling and controlling., John Wiley& Sons, Inc. New Jersey, 2003 5. Maj T., Organizacja budowy. Podręcznik., Wyd. Szkolne i Pedagogiczne Spółka Akcyjna, Warszawa, 2007		
Knowledge	Rozróżnia struktury oganizacjyjne budów o różnej skali wielkości, proponuje rozwiązania organizacji i zagospodarowania placu budowy, dobiera metodologię wykonania robót dla róąnych projektów.		
Skills	Oblicza nakłady pracy dla poszczególnych rodzajów robót,planuje pracę grup roboczych na placu budowy, ocenia zagrożenia i podejmuje działania zabezpieczające.		
Other social competences	Jest odpowiedzialny za bezpieczeństwo własne i zespołu,jest odpowiedzialy za wspoólnie realizowane zadania, ma świadomość przestrzegania etyki zawodowej		

Course title	Site Management II		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Magdalena Bochenek	**E-mail address to the person**	Magdalena.Bochenek@zut.edu.pl
Course code (if applicable)	WBiIS-1-23-S	**ECTS points**	3.0
Semester	summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Student to be familiar with construction technology and planning of basic resources Working-out of construction schedules		
Entry requirements	Passing of the course - Site Management I Passing of the course - Project Management I		
Course contents	Construction schedulling with MS Project software, Elaboration pass, Fundamentals of time management of construction site activities - types of schedules and their application, Critical Path Method (CPM) – the principles of network schedulling, Basic relationships between activities in construction network schedulling with MS Project, The calculation methods of construction works timing, Development and optimization of human resources diagram, Balancing of employment with regards to critical path and building costs, Optimization of Project schedule - methods of improvement,		
Assessment methods	Informative lectures Projects` methodology Examination test Case study pass		
Recommended readings	1. Rory Burke, Project Management Planing and Contraction, John Wiley & Sons, 1992 2. Andersson C.A.,Miles D., Neale R., Ward J., Site management. Workbook., Ineternational Labour Office, Geneva, 1996 3. Praca zbiorowa, English for construction managers and engineering. Part 2: Principles of the management in construction., Poltext, Warszawa, 2008 4. Kerzner H., Project Management. A system approach to planning,scheduling and controlling., John Wiley& Sons, Inc. New Jersey, 2003		
Knowledge	Znajomość metod planowania oraz identyfikacji parametrów projektu krytycznych dla terminowego i efektywnego wykonania robót na budowie		
Skills	Sporządzanie harmonogramów szczegółowych dla robót budowlanych za pomocą programu MS Project		
Other social competences	Odpowiedzialny za bezpieczeństwo własne i zespołu oraz zapowierzone mu zadania, przestrzega eyyki zawodowej.		

Course title	Soil Mechanics		
Level of course	first cycle		
Teaching method	auditory class / laboratory class / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-27-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To understand the basic description of soil mass with affecting external loads to estimate strength properties of soil based on the results of tests To apply the knowledge of soil behaviour to geotechnical design		
Entry requirements	Completed course of engineering geology Completed course of strength of materials Completed course of theoretical mechanics English language competence at B2 level Completed course of structural mechanics		
Course contents	Discussion on soil parameters, soil clasiffication analysis, calculation of parameters, calculations of stresses due to point loads, rectangular unit loads, analysis of vertical stress distribution at various stages of construction. Settlement and consolidation calculations. Shear strength calculations, principal stress. Active and passive earth pressure calculations, resultant diagram and force. Laboratory tests of soil paramaters (sieve analysis - grain size distribution, water content, density, Atterberg limits, shear strength tests, Proctor test, oedometric tests, permeability coefficient, density index) Basic characteristics of soil, deposits, origin, three-phase nature of soils Physical properties of soil (density, unit weight, porosity, void ratio, water content, Atterberg limits, density index, plasticity index, consistency index, grain-size distribution, uniformity coefficient) Soil classifications (AASHTO, USCS, EN ISO). Soil compaction. Standard Proctor Test. Factors affecting compaction Hydraulic conductivity and seapage Stresses in soil. Effective stress concept. Stress due to external loading (point load - Boussinesq equation, ractangularly loaded area, circular loaded area). Changes of vertical stress with phases of construction works. Consolidation, normally consolidated and overconsolidated soils, OCR ratio. Introduction to Terzaghi theory of consolidation. Coefficient of consolidation (logarithm of time method, square root of time method). Application to settlement calculations. Oedometric tests Shear strength of soil. Coulomb - Mohr failure criteria. Laboratory determination of shear strength parameters. Direct shear test. Triaxial shear tests (CD-test, CU-test, UU-test). Lateral earth pressure. Rankine's theory of active and passive pressures. Coulomb's theory of earth pressure. Application of pressure distribution diagrams to retaining walls and shallow foundations. Basics of bearing capacity of shallow foundations		
Assessment methods	Lecture Tutorials laboratory Written test of lecture and tutorials content Continuous assessment of laboratory reports written tests of tutorials		
Recommended readings	1. J. A. Knappett and R. F. Craig, Craig's Soil Mechanics, Spon Press, 2012, Eight Edition 2. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2011, 3rd Edition, Knovel, Earth Sciences 3. Smith I., Smith's Elements of Soil Mechanics. 8th Edition. Design to Eurokode 7, Blackwell Publishing, Oxford, 2006, 8, VIII-114 4. Braja M. Das, Fundamentals of Geotechnical Engineering, Cengage Learning, 2013, 4th Edition, International Edition 5. W. Powrie, Soil Mechanics. Concepts and Applications, CRC Press Taylor & Francis Group, 2014, Third Edition 6. Bowles J. E., Foundation Analysis and Design, McGraw-Hill, 1996, Knovel Release Date 2007-01-02 7. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows soil clasiffications, basic soil propertis and stress distribution, knows how to calculate earth pressures		
Skills	Student is able to calculate and analyse the results from laboratory testing, is capable to distinguish changes in stresses due to different stages of construction. Student is able to draw a diagram of earth pressures and provide calculations.		
Other social competences	Students is able to predict a soil mass failure on basis of principal theories and understand any danger that may appear for working people. Feels responsible for their safety.		

Course title	Spectroscopic Method in Environmental Engineering		
Level of course	first cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Magdalena Janus	**E-mail address to the person**	Magdalena.Janus@zut.edu.pl
Course code (if applicable)	WBiIS-1-54-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Possessing theoretical knowledge and practical skills to perform analyzes using: spectrophotometry in visible and UV light, atomic absorption spectroscopy, gas chromatography with mass spectrometry and total organic carbon analyser.		
Entry requirements	Basics of general chemistry in the field of secondary school		
Course contents	UV-VIS spectroscopy Atomic Absorption Spectroscopy Gas chromatography coupled with mass spectroscopy Total Organic Carbon Analysis Classification of instrumental methods Spectrophotometry in visible and UV light Atomic absorption spectrophotometry Gas chromatography Liquid chromatography Mass spectrometry Infrared spectrofotometry Total Organic Carbon analysis		
Assessment methods	Lectures Laboratories Passing the laboratories will be based on the performance of all laboratories provided for in the plan and the preparation of a report. Passing the material covered by the lecture program		
Recommended readings	1. Hans Kuzmany, Solid-state spectroscopy: an introduction, Springer, Berlin, 1998 2. J. Workman, A.W. Springsteen, Applied Spectroscopy, 1997		
Knowledge	Knowledge of spectroscopic method in environmental engineering		
Skills	ability to use instrumental methods in environmental engineering		
Other social competences	She/he has a competence to work in a team		

Course title	Strength of Materials 1		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Hanna Weber	**E-mail address to the person**	Hanna.Weber@zut.edu.pl
Course code (if applicable)	WBiIS-1-09-WS	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	To learn the basics of structural analysis: design loads, types of elements and supports, internal forces – drawing the diagrams, cross-section properties.		
Entry requirements	Mathematics		
Course contents	Design loads Stability of the structural system. Statics of structures - reactions. Internal forces – drawing the diagrams for planar trusses, beams and frames. Cross-section properties. Test Aims of structural engineering. Theory of structures. Structural elements and their behaviour: beams, frames, trusses and arches. Design loads. Types of supports - reactions. Statics of structures. Stability of the system. Internal forces – drawing the diagrams for planar trusses, beams and frames. Cross-section properties Static indeterminacy.		
Assessment methods	Information lecture Issue lecture Audio-visual presentation Computational exercises Continuous assessment in practical classes Final test		
Recommended readings	1. K.M. Leet, Ch.-M. Uang, A.M. Gilbert, Fundamentals of Structural Analysis, McGraw-Hill, 2011, fourth edition 2. W. M.C McKenzie, Examples in structural analysis, Taylor and Francis, 2007 3. P. Garrison, Basic Structures for Engineers and Architects, Blackwell, 2008 4. M.A. Sozen, T. Ichinose, Understanding Structures. An introduction to Structural Analysis., CRC, 2009 5. R.S. Narayanan, A.W. Beeby, Introduction to Design for Civil Engineers, Spon., 2001		
Knowledge	Student knows the design loads, types of elements and supports, internal forces.		
Skills	Student is able to draw the diagrams of internal forces for planar trusses, beams and frames. Student is able to calculate the cross-section properties.		
Other social competences	The student is aware of the responsibility for his own calculations		

Course title	Strength of Materials 2		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Hanna Weber	**E-mail address to the person**	Hanna.Weber@zut.edu.pl
Course code (if applicable)	WBiIS-1-24-WS	**ECTS points**	5.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To gain knowledge of simple stresses, strains and deformation in components due to external loads To assess stresses and deformations through mathematical models of beams, torsion bars or combinations of both. Understanding the influence of loads and dimensions of structural elements on the values of stresses and deformations.		
Entry requirements	Mathematics Theoretical mechanics Strength of Materials 1		
Course contents	Axial stretching/compression Simple bending. Bending with shear forces. Oblique bending, bending in two planes. Eccentric stretching/compression. Deflection of beams. Torsion bars with circular cross-section. The stability of a straight bar. Bending with compression. Written tests 2x2h Introductory information: stress, strain, Hooke's law, the basic material constants. Axial stretching/compression Simple bending. Bending with shear forces. Oblique bending, bending in two planes. Eccentric stretching/compression. Deflection of beams. Torsion bars with circular cross-section. The stability of a straight bar. Bending with compression.		
Assessment methods	Information lecture Issue lecture Audio-visual presentation Computational exercises Continuous assessment in practical classes Project work Written exam		
Recommended readings	1. Da Silva V.D., Mechanics and strength of materials, Springer Verlag, 2006 2. Beer F. P., Johnston R., Dewolf J.T., Mazurek D.F., Mechanics of Materials, McGraw-Hill Book Co, 2012, Sixth Edition 3. Nash W.A, Theory and problems in Strength of Materials, McGraw-Hill Book Co, New York, 1995 4. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981 5. Ray Hulse, Keith Sherwin & Jack Cain, Solid Mechanics, Palgrave ANE Books, 2004		
Knowledge	Student has the basic knowledge about axial, torsion, bending and combined stresses, types of strain and elastic behavior of materials.		
Skills	Student is able to analyze and design structural members subjected to axial, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.		
Other social competences	The student is aware of the responsibility for his own calculations		

Course title	Sustainable Water Management		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Dorota Stocka	**E-mail address to the person**	Dorota.Stocka@zut.edu.pl
Course code (if applicable)	WBiIS-1-25-WS	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Upon successful completion of this course, the student will be able to: - understand the need for sustainable water management - understand the concept of sustainability and sustainable land development - describe the impact of urban development on the hydrologic sycle and water quality of watersheds and sub-watersheds.		
Entry requirements	Basic Hydrology and hydraulics. Level S1 Civil Engineering		
Course contents	Preparing a conceptual plan of sustainable water management on a single residential lot. Introduction to the concept of sustainability and the idea of sustainable water management. Introduction to the non-traditional "green" infrastructure in water management. Introduction to the major green infrastructure design considerations: environmental protection, stream habitat protection, protection of soils and vegetation, pollution prevention planning, sustainable urban landscape, and subsurface utility engineering.		
Assessment methods	Lecture Presentations and video movies Obtaining grade for project work		
Recommended readings	1. Vallero, Daniel; Brasier Chris, Sustainable Design - The Science of Sustainability and Green Engineering, John Willey & Sons, 2008 2. Develop with Care 2012. Environmental Guidelines for Urban and Rural Land Development in BC, Canada, 2012, on-line pdf document		
Skills	Upon successful completion of this course, the student will be able to: - understand the need for sustainable water management - understand the concept of sustainability and sustainable land development - describe the impact of urban development on the hydrologic cycle and water quality		

Course title	Technology of Foundation Works		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-1-26-WS	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To provide knowledge on technologies used in foundation engineering Create ability to prepare and make use of presentations skills in English		
Entry requirements	Completed course of engineering geology Completed course of strength of materials Completed course of structural mechanics Completed course on fundamentals of foundation engineering English language skills at B2 level		
Course contents	Basic design of axially loaded pile and sheet piling support of excavation pit. Spread foundation technology. Raft foundations, deep shaft foundations. Site preparation, foundations construction. Excavation methods, trench excavation, support of excavations. Pile technology with various geotechnical conditions. Basics of axially loaded pile design. Static and dynamic test loading. Sheet piling technology, cofferdams, anchoring systems. Basics of groundwater lowering in construction.		
Assessment methods	Lecture Methods of projects Continuous assessment of project development Defence of the project, discussion of results within a group Oral completion		
Recommended readings	1. Bowles J. E., Foundation Analysis and Design, McGraw-Hill, 1996, Knovel Release Date 2007-01-02 2. Budhu M., Soil Mechanics and Foundations, John Wiley & Sons, 2007, Knovel Release Date: Aug 5, 2009, Earth Sciences 3. Cashman P. M., Preene M., Groundwater Lowering in Construction. A practical guide, Spon Press, London, New York, 2001 4. Cernica J. N., Geotechnical Engineering: Foundation Design, John Wiley & Sons, New York, 1995 5. Day R. W., Foundation Engineering Handbook - Design and Construction with the 2006 International Building Code, McGraw-Hill, 2006, Knovel Release Date: 2006-08-09 6. Kalinski M. E., Soil Mechanics. Laboratory Manual, John Wiley & Sons, Hoboken, New Jersey, 2005, Knovel 7. Monahan E. J., Construction of Fills, John Wiley & Sons, 1994, 2, Knovel Release Date: 2007-08-22 8. Smith I., Smith's Elements of Soil Mechanics. 8th Edition. Design to Eurokode 7, Blackwell Publishing, Oxford, 2006, 8, VIII-114 9. Tomlinson M. J., Foundation Design and Construction, Prentice Hall, Harlow, 2001, 7 10. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows typical technologies of foundations works		
Skills	Student is able to: prepare a geotechnical design of a foundation under given construction with a proper excavation support if needed, and discuss the chosen technologies		
Other social competences	Understands safety rules in foundation works		

Course title	Technology of Steel Structures		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Agnieszka Pełka-Sawenko	**E-mail address to the person**	Agnieszka.Pelka-Sawenko@zut.edu.pl
Course code (if applicable)	WBiIS-1-34-S	**ECTS points**	3
Semester	summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Familiarity with manufacture technology of complex structural steelwork; practical skill to design elementary parts of the vertical steel chimney for industry.		
Entry requirements	Mathematics Strength of materials Structural mechanics Rules of design of steelwork Technical drawing		
Course contents	Design of chimney's. Calculation: static-durability of chimney’s parts, montage joints between segments and chimney-foundation connection. Calculation with the rul of Eurocode 3 and Eurocode 1, etc. Introduction to steel’s role in construction industry: mild steel as a backbone of the industry, the world steel production, costs of construction works and steelwork costs, European system of steel grades notation Chimney: classification, basic rules of shell design, foundation connection design, technology of execution. Welding of structural steelwork: welding process and consumables, typical weld details, weld defects and quality control Fabrication: form of contract and organization. Erection: design for erection Corrosion protection: basic theory, paint and metal coatings. Fire protection: regulation requirements, properties of steel, protection of members		
Assessment methods	Information lecture Issue lecture Audio-visual presentation Mark for the design Written tests		
Recommended readings	1. Eurocode 0 – Basis of structural design. 2. Eurocode 1 – Actions on structures. 3. Eurocode 3 – Design of steel structures. 4. EN 13084-1:2007 Free-standing chimneys - Part 1: General requirements. 5. EN 13084-7:2006 Free-standing chimneys - Part 7 Product specifications of cylindrical steel fabrications for use in single wall steel chimneys and steel liners. 6. Owens G. W., Knowles P.R., Dowling P.J., Steel Designers' Manual, Blackwell, Scientific Publications, Cambridge, 2003 7. Dowling P.J., Knowles P.R., Owens G.W, Structural Steel Design, Butterworths, London, 1988 8. Gardner L., Nethercot D. A., Designers Guide to EN 1993-1-1 – Design of steel structres general rules and rules for buldings.		
Skills	As a result of the course the student will hold the knowledge of the organization and management of problems occurring in the implementation of steel structures, where based on the relevant standard is able to design industrial construction of the specified object (chimney) and the impact of typical technologies for its implementation.		

Course title	Theoretical Mechanics		
Level of course	first cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Krzysztof Wierzbicki	**E-mail address to the person**	Krzysztof.Wierzbicki@zut.edu.pl
Course code (if applicable)	WBiIS-1-29-W	**ECTS points**	4
Semester	winter	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Ability to identify systems statically determinate and indeterminate The designation of the reaction in various types of structures Determination of forces in truss rods Application of laws of dynamics and kinematics		
Entry requirements	Mathematics Physics		
Course contents	The auxiliary messages from vector calculus. Newton's law. Basic concepts of mechanics. Models of real objects. Principles of statics. Moment of force with respect to the point. Systems of forces. The main vector and main moment. Reduction of the system of forces. Reduction in individual cases systems of forces. The balance of forces converging. Rigid body in the system flat and spatial degrees of freedom, constraints. The balance of flat systems of forces. Conditions of determine static and geometric invariance of the scheme. Methods for determining the forces in truss rods. Fundamentals of mechanics analytical. Kinematics of material point. Selected methods for the description of motion. Speed and acceleration. Kinematics rigid body. Dynamics of material point and the material system. Differential equations of motion. Free movement of damping. Harmonically forced oscillation of a simple example. Written tests 2x2h The auxiliary messages from vector calculus. Newton's law. Basic concepts of mechanics Models of real objects. Principles of statics. Moment of force with respect to the point. Systems of forces The main vector and main moment. Reduction of the system of forces. Reduction in individual cases systems of forces. The balance of forces converging Rigid body in the system flat and spatial degrees of freedom, constraints The balance of flat systems of forces Conditions of determine static and geometric invariance of the scheme Methods for determining the forces in truss rods Fundamentals of mechanics analytical Kinematics of material point. Selected methods for the description of motion. Speed and acceleration. Kinematics rigid body Dynamics of material point and the material system. Differential equations of motion. Free movement of damping. Harmonically forced oscillation of a simple example		
Assessment methods	Information lecture Issue lecture Audio-visual presentation Computational exercises Continuous assessment in practical classes Written exam		
Recommended readings	1. Symon Keith, Mechanics, ADDISON WESLEY PUB CO INC, 1971 2. Stephen T. Thornton, Classical Dynamics of Particles and Systems, 2003 3. J.B. Marion and S.T. Thornton, Classical dynamics of particles and systems, 1995 4. John R. Taylor, Classical Mechanics, University Science Books, 2005 5. Edwin F. Taylor and John Wheeler, W. H. Freeman and Co., Spacetime Physics, 1966		
Knowledge	The student knows how to use the vector employed for determining the response in static and dynamic. The student knows how to determine the characteristics of simple cross-section rods.		
Skills	The student can solve simple static and dynamic rod systems. The student is able to formulate and solve problems with cross-sectional geometry of the rods.		
Other social competences	The student is aware of the responsibility for his own calculations		

Course title	Urban Water Engineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Norbert Laskowski	**E-mail address to the person**	Norbert.Laskowski@zut.edu.pl
Course code (if applicable)	WBiIS-1-47-W	**ECTS points**	3
Semester	winter	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Knowlegde of modern approach to desiging storm water systems in urban areras		
Entry requirements	Hydrology Liquid mechanics		
Course contents	Map preparation using Qgis Water management in urban aeras - balance calculations. Desigining stormwater system in single catchement. Hydraulic calculations. Water management using infiltration facilities. Infiltration facilities - calculations. Discharging rainwater into waterways Land improvement Precipitation measurements. Runoff coefficient and effective rainfall estimation. Drainage system. Irrigation system. Urban drainage. Rain water management. Hydrological modeling. Final task		
Assessment methods	Lectures Design workshops Continuous assessment Projekt works Written exam		
Recommended readings	1. Eslamian Saeid, Handbook of engineering hydrology, Taylor & Francis, Boca Raton, 2014 2. Petr Hlavinek, Martina Zelenakova, Storm Water Management, Springer Hydrogeology, 2015 3. Dahl TE, Johnson CE, Frayer WE, Wetlands, status and trends in the conterminous United States, mid-1970s to mid-1980s: first update of the national wetlands status report, US Dept.of the Interior, Fish and Wildlife Service,, Washington, DC, 1991 4. Mitsch WJ, Gosselink JG, Wetlands, New York: Van Nostrand Reinhold, New York, 1993, 2ns ed. 5. Kadlec, R.H. and Wallace, S.D., Treatment wetlands, Taylor and Francis Group, Boca Raton, 2009, 2nd ed., ISBN 978-1-56670-526-4		
Knowledge	Student has knowlegde of modern approach to desiging strom water systems in urabn aeras		
Skills	Student can design and calculate drainage system for single catchment.		
Other social competences	Student can cooperate and discuss his ideas.		

Course title	Water Resources Engineering		
Level of course	first cycle		
Teaching method	project / lecture		
Person responsible for the course	Dorota Stocka	**E-mail address to the person**	Dorota.Stocka@zut.edu.pl
Course code (if applicable)	WBiIS-1-31-WS	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Upon successful completion of this course, the student will be able to: - understand major issues related to water resources engineering - understand the concept of sustainable water resources management - understand the planning and design principles of watr supply, stormwater management, reservoirs, wells, flood mitigation, irrigation and drainage, and hydropower.		
Entry requirements	Basic Hydrology and hydraulics. Fluid Mechanics (open channels aand closed conduits)		
Course contents	Preparing assesments for classes Introduction to water resources management. Investigation of a wide range of water resoures issues, methods of analysis and solutions. Topics include: water distribution systems, hydraulics, surface water hydrology, rainfall and runoff, drainage channels, sanitary sewers, flood control structures, reservoirs, hydrotechnical structures, grandwater, water resources planning.		
Assessment methods	Lecture Presentations and video movies Research on Internet Obtaining grade for assessments		
Recommended readings	1. Vallero, Daniel; Brasier Chris, Sustainable Design - The Science of Sustainability and Green Engineering, John Willey & Sons, 2008 2. Linsley R. K. and Franzini J. B., Water Resources Engineering, McGraw-Hill Book Inc., New York, 1992 3. Chin, David A., Water-Resources Engineering, PEARSON, London, UK, 2013, Third Edition		
Skills	Upon successful completion of this course, the student will be able to: - understand major issues related to water resources engineering - understand the concept of sustainable water resources mngt - understand the planning and design principles of water supply, reservoirs, flood protection, drainage and hydropower		