Faculty of Civil and Environmental Engineering

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY
IN SZCZECIN, POLAND

THE OFFER FOR INTERNATIONAL STUDENTS FOR THE YEAR 2021/2022 SECOND DEGREE

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
1	Advanced Geoengineering	Zygmunt Meyer	winter/summer	2	30
2	Applied Mathematics in Engineering	Bogdan Ambrożek	winter/summer	4	60
3	Computer methods in municipal infrastructure analysis and design	Dorota Stocka	winter/summer	4	45
4	Finite Element Method – Applications in Engineering	Bogdan Ambrożek	winter/summer	4	60
5	Special Foundations Design	Andrzej Pozlewicz	winter/summer	5.0	90
6	Structural Dynamics	Radosław Iwankiewicz	winter/summer	3	45

Course title	Advanced Geoengineering		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zygmunt Meyer	**E-mail address to the person**	Zygmunt.Meyer@zut.edu.pl
Course code (if applicable)	WBiIS-2-03-WS	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Familiarize the student with various foundation load systems, teach him how to design special foundation elements in complex geotechnical conditions		
Entry requirements	Advanced soil mechanics Basic of buliding mechanics		
Course contents	Project of the foundation of the building segment Cooperation of the slab with the pile system Box foundations Foundation of high objects under complex load conditions and difficult geotechnical conditions in category III (high buildings, masts, wind power towers) Designing foundations for machines Foundation of communication engineering objects (bridges, viaducts, embankments, deep excavations, underground constructions Foundation of hydrotechnical construction objects (wharfs, locks, weirs, breakwaters)		
Assessment methods	Information lecture method Case study lecture method Pracitical desing project method Countinous rating of student progress Final test rating		
Recommended readings	1. Braja M. Das., Introduction to Geotechnical Engineering, 1985		
Knowledge	Student has a thorough knowledge in the field of foundation of objects in variable load conditions and in complex geotechnical conditions. He knows the principles of constructing and dimensioning the foundations of complex structures and building objects.		
Skills	Is able to solve the problems of founding simple and complex buildings in difficult geotechnical conditions by integrating knowledge in the field of various branches of science related to construction		
Other social competences	Student is able to apply the knowledge used in the implementation of the engineering task undertaken in a responsible and professional manner		

Course title	Applied Mathematics in Engineering		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Bogdan Ambrożek	**E-mail address to the person**	Bogdan.Ambrozek@zut.edu.pl
Course code (if applicable)	WBiIS-2-05-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. Describe engineering problems in mathematical form. 2. Identify analytical solution to the differential equations. 3. Interpret the solution to differential equations.		
Entry requirements	Fundamentals of mathematics.		
Course contents	Formulation of engineering problems. Solution of ordinary differential equations. Solution of coupled Simultaneous ODE. Numerical solution of ODEs: initial value problems and boundary value problems. Analytical and numerical solution of PDEs. Solution of differential equations using Laplace transforms. Formulation of engineering problems. Modelling: model building process. Model hierarchy. Models with many variables. Boundary conditions. Vector spaces. Matrices. Matrix algebra: row operations, direct elimination methods, iterative methods. Ordinary differential equations. First-order equations. Solution methods for second-order nonlinear equations. Linear equations of higher order. Coupled Simultaneous ODE. The calculus of finite differences. Approximate methods for ODE solution. Initial value problems. Boundary value problems. Laplace transforms. Solution techniques for solving PDEs. Solution techniques for solving PDEs.		
Assessment methods	Lecture illustrated by Power Point presentation and manual and computer calculations Classes illustrated by computer and manual calculations Periodic assessment of student achievement Lecture: exam at the end of the semester Classes: written test		
Recommended readings	1. Dasgupta B., Applied Mathematical Methods, Pearson Education India, 2006 2. Riley K.F., M.P. Hobson M.P., Bence S.J., Mathematical methods for physics and engineering, Cambridge University Press, 2006 3. Hayek S. I., Advanced Mathematical Methods in Science and Engineering, CRC Press, 2010 4. Bayin S.S., Mathematical Methods in Science and Engineering, Wiley, 2006 5. Rice R.G., Do D.D., Applied mathematics and modeling for chemical engineers, Wiley, New York, 2012 6. Finlayson B.A., Introduction to chemical engineering computing, Wiley, New York, 2005 7. Loney N.W., Applied Mathematical Methods for Chemical Engineers, CRC, Boca Raton, 2015		
Knowledge	The student will be able to describe engineering processes in mathematical form.		
Skills	The student will be able to identify analytical and numerical solution to the differential equations.		
Other social competences	The student will be able to interpret the solution to differential equations.		

Course title	Computer methods in municipal infrastructure analysis and design		
Level of course	second cycle		
Teaching method	project course		
Person responsible for the course	Dorota Stocka	**E-mail address to the person**	Dorota.Stocka@zut.edu.pl
Course code (if applicable)	WBiIS-2-01-WS	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Understanding the practical application of various computer methods and software in civil/municipal infrastructure (water supply, sanitary sewage and storm drainage) design, modelling and analysis. Understanding the need for computer modeling simulation in civil and environmental engineering design and municipal utylity management. Understanding equitation-solving software and modelling processes. Understanding the input data and output results.		
Entry requirements	Advanced Hydrology and Hydraulics Fluid Mechanics (open channels and closed pipe systems) Design of water and sewerage systems		
Course contents	Review and hands-on experience of computer methods, engineering applications and software programs available in civil engineering industry for municipal utility design (water supply, sewage and storm water systems). Hands-on experience with computer methods and software applications for civil engineers		
Assessment methods	Project preparation with the use of computer and software Obtaining grade for project work		
Recommended readings	1. Walski Thomas, Chase Donald, Savic Dragan, Water distribution modeling., Headstad Methods - Watrbury Headstad Press, 2001 2. Durrans Rocky, Stormwater conveyance, modeling and design, Headstad Methods - Waterbury Headstad Press, 2003		
Skills	Upon successful completion of this course, the student will be able to: - build a computer model of storm and sanitary sewer system with the applicstion of basic municipal/national design criteria - perform a hydrodynamic simulation of the model - prepare and print a report		

Course title	Finite Element Method – Applications in Engineering		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Bogdan Ambrożek	**E-mail address to the person**	Bogdan.Ambrozek@zut.edu.pl
Course code (if applicable)	WBiIS-2-06-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 FEM to solve engineering problems. 2. Understand how the FEM algorithms work.		
Entry requirements	Mathematics		
Course contents	Problems related to mass transfer. Problems related to heat transfer. Problems in fluid mechanics. Problems in Structural Dynamics Problems in Rock Mechanics Problems in soil mechanics. An introduction to FEM Fundamentals of discretization and approximation functions Finite element equations based on the method of weighted residuals and on the principle of minimum potential energy Linear structural analysis. Linear analysis of field problems. Nonlinear structural analysis Introduction to computer programming aspects of the finite element method. Applications of FEM in engineering. Example problems and solutions.		
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. E. Madenci, Guven I., The Finite Element Method and Applications in Engineering Using Ansys®, Springer, Berlin, 2003 2. Quek S. S., Liu G.R., The Finite Element Method: A Practical Course, Butterworth-Heinemann, 2006 3. Zhu B., The Finite Element Method: Fundamentals and Applications in Civil, Hydraulic, Mechanical and Aeronautical Engineering, Wiley, 2018 4. Akin J. E., Finite element analysis with error estimators: an introduction to the FEM and adaptive error analysis for engineering students, Elsevier/Butterworth-Heinemann, 2005 5. Heinrich J.C., Pepper, D.W., The finite element method : basic concepts and applications with MATLAB, MAPLE, and COMSOL, CRC, 2017		
Knowledge	The student knows the FEM algorithms		
Skills	The student will be able to use FEM in engineering.		
Other social competences	The student will be able to use of FEM to solve engineering problems.		

Course title	Special Foundations Design		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Andrzej Pozlewicz	**E-mail address to the person**	Andrzej.Pozlewicz@zut.edu.pl
Course code (if applicable)	WBiIS-2-02-WS	**ECTS points**	5.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	6	**Hours per semester**	90
Objectives of the course	Create an ability to recognize and use of proper foundation in case of massive construction and complex load systems Create an ability to prepare a geotechnical design of special foundation		
Entry requirements	Completed course of soil mechanics Completed course of engineering geology Completed course of foundations design Completed course of structural mechanics		
Course contents	Design of special foundation in complex geotechnical conditions Advanced geotechnical aspects in special foundation design Load transfer mechanism in pile, pier and shaft foundation Meyerhof's method for bored and displacement driven piles "Alpha", "lambda" and "betha" methods for shafts and piers Elastic foundation Test loads, Davisson formulae Negative skin friction, neutral depth (Vesic, Bowles) Group of piles, drilled shafts - technology and design Brich Hansen method for lateral loading (free and fixed head) Soil spring idealization, elastic continuum model (Poulos, Reese and Matlock, Broms approaches) Anchoring systems in special foundation design		
Assessment methods	Project based learning method Lecture, case studies Project work continuous assessment Project presentation and defence		
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. Day R. W., Foundation Engineering Handbook - Design and Construction with the 2006 International Building Code, McGraw-Hill, 2006, Knovel Release Date: 2006-08-09 4. Cernica J. N., Geotechnical Engineering: Foundation Design, John Wiley & Sons, New York, 1995 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. Monahan E. J., Construction of Fills, John Wiley & Sons, 1994, 2, Knovel Release Date: 2007-08-22 8. Cashman P. M., Preene M., Groundwater Lowering in Construction. A practical guide, Spon Press, London, New York, 2001 9. Venkatramaiah C., Geotechnical Engineering, John Wiley & Sons, 1993		
Knowledge	Student knows systems of modern foundations design in case of not standard construction		
Skills	Student is able to: analyze geotechnical solutions for various special foundations, provide comparative analysis for given solutions, make calculations of bearing capacity of a special foundation		
Other social competences	Student is able in both professional and responsible way use gained knowledge and skills in executions works associated with special foundations engineering. Understands the engineering activities effect on environment		

Course title	Structural Dynamics		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Radosław Iwankiewicz	**E-mail address to the person**	riwankiewicz@zut.edu.pl
Course code (if applicable)	WBiIS-2-04-WS	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Capability to write down the equations of motion of single- and multi-degree-of-freedom linear systems with the aid of Newton'second law, the principle of angular momentum and Lagrange's equations as well as capability to determine the natural frequency of single-degree-of-freedom systems. Capability to formulate and solve the eigenvalue problem (to determine the natural frequencies and eigenvectors) for multi-degree-of-freedom systems. Capability to determine the forced vibration response of single- and multi-degree-of-freedom linear systems to harmonic and some non-periodic excitations. Capability to formulate the buckling problem and to determine the critical load for rods (columns) with different boundary conditions and for simple plane frames.		
Entry requirements	Mathematics courses pertinent to BSc in Engineering degree course Structural Mechanics		
Course contents	Example problems: derivation of equations of motion of SDOF systems, determination of natural frequency. Example problems: derivation of equations of motion of MDOF systems. Solving eigenvalue problem for MDOF systems, determination of natural frequencies and eigenvectors. Determination of amplitudes of steady-state response of a MDOF system to harmonic excitation. Determination of critical load for rods (columns) with different boundary conditions and for simple plane frames. Degrees of freedom and generalized co-ordinates. Constraints and their combinations. Equations of motion: Newton'second law and principle of angular momentum. Oscillatory motions and their superposition. Single-degree-of-freedom (SDOF) systems: equation of motion, undamped and damped free vibrations. Forced vibrations: harmonic excitation, excitation due to rotating unbalance, base motion excitation, non-periodic excitations. Lagrange's equations. Multi-degree-of-freedom (MDOF) systems: equations of motion, eigenvalue problem (eigenvalues, natural frequencies, eigenvectors), damping hypotheses. Forced vibrations: direct approach and modal transformation technique for harmonic excitation. Transverse vibrations of a beam: equation of motion, eigenvalue problem (eigenvalues, natural frequencies, eigenfunctions – normal modes), different boundary conditions. Stability of equilibrium positions. Structural stability: buckling of elastic rods (columns), buckling of plane frames (displacement method approach).		
Assessment methods	Lectures. Solving problems and home assignments. Final exam mark. Assessment of home assignments.		
Recommended readings	1. W.C. Hurty and M.F. Rubinstein, Dynamics of Structures, Englewood Cliffs: Prentice Hall, 1964 2. S.S. Rao, Mechanical Vibrations, Addison-Wesley, 1995, 3rd edition 3. C.F. Beards, Engineering Vibration Analysis with Application to Control Systems, Edward Arnold, 1995 4. M. Geradin, D.Rixen, Mechanical Vibrations. Theory and Application to Structural Dynamics, J. Wiley, 1994		
Knowledge	Student should be able to develop simple mathematical models for vibration analysis and to formulate the buckling problems.		
Skills	Student should be able to solve numerically the eigenvalue problems and equations of motion in vibration problems. He/she should also be able to solve the equations governing the buckling problems.		
Other social competences	Student shows the capability to make a plan for an undertaken research/computational project, to execute it and to observe deadlines.		