GDANSK UNIVERSITY OF TECHNOLOGY

FACULTY OF CIVIL AND
ENVIRONMENTAL ENGINEERING

Full-time MSc Studies in Civil Engineering

Study programme syllabus

Academic year 2015/2016

Full-time MSc Studies in Civil Engineering

	Lp.	O/F	Symbol	Subject	Sem. I					Sem. II						Sem. III					
					L	T	L	P	ECTS	L	T	L	P	S	ECTS	L	T	L	P	S	ECTS
Civil Engineering	1	O	K_W01, K_U03, K_U10	Mathematics	30	30			5												
	2	O	K_W03, K_W04, K_U03, K_U10	Theory of Elasticity and Plasticity	30	30			5												
	3	O	K_W02, K_W07, K_W16, K_W19, K_U02, K_U18	Complex Concrete Structures*	30	15		15	4												
	4	O	K_W02, K_W07, K_W19, K_U02	Complex Steel Structures*	30	15		15	4												
	5	O	K_W06, K_W12, K_W18, K_W20, K_W21, K_U07, K_U19, K_K06	Construction Management	30	15		15	6												
	6	O	K_W05, K_W16, K_U08, K_U20	Advanced Foundations	15			15	2												
	7	O	K_W14, K_U01, K_U15	Hydro and Marine Civil Engineering	30	15			2												
	8	O	K_W23, K_U11	Hydraulics and Hydrology	15	15	15		2												
	9	O	K_W01, K_W04, K_U04, K_U05, K_U06, K_U10, K_U16	Finite Element Method						30		30			4						
	10	O	K_W16, K_U01	Wind and Earthquake Engineering						30	15				3						
	11	O	K_W15	Engineering Surveying						15			15		3						
	12	O	K_W04, K_W22, K_U03	Reliability of Structures						30	15				3						
	13	O	K_W02, K_U06, K_U02	Bridge Structures						30			15		3						
	14	O	K_W08, K_W09, K_W10, K_W16, K_U12, K_U13, K_U14, K_U17	Transportation Engineering						30		30			3						
	15	O	K_W15, K_U08	Geotechnics						45			30		5						
	16	O	K_W03, K_U03	Structural Dynamics						30	15				3						
	17	O	K_W07, K_W11, K_W22, K_U21, K_K05, K_K08	Seminar on Civil Engineering										30	3						
	18	O	K_W01, K_W04, K_U05, K_U06, K_U10	Finite Element Method - applications																30	3
	19	O	K_W71, K_U71	Socio-humanistic subject												30					2
	20	O	K_W17, K_U20	Geology and Hydrogeology												15		15			2
	21	O	K_W22, K_U21, K_K01	Thesis Seminar																45	3
	23	O	K_W22, K_U09, K_U21, K_K02, K_K03, K_K04, K_K07, K_K08	Thesis																	20
				Total number of hours/ECTS	210	135	15	60	30	240	45	60	60	30	30	45	0	15	0	75	30
				Total number of hours:	420					435						135					

* The subject includes team project

exam

Code: **BSD001** **MATHEMATICS**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Eligiusz Mieloszyk</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Differential Equations and Applications of Mathematics</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 5</td></tr>
<tr><td>30</td><td>30</td><td></td><td></td><td></td><td>Assessment: exam</td></tr>
</table>

Topics:

Partial differential equations. Classification of partial differential equations. Discriminant of a partial differential equation of the second order with real coefficients. Elliptic, parabolic and hyperbolic equations. Applications of partial differential equations. Selected methods of solving of partial differential equations.

Elements of calculus of variations. A definition of a functional, a definition of an extreme of a functional, a fundamental lemma of calculus of variations, Euler equation, necessary condition of existence of an extreme of a functional, Jacobi equation, Jacobi condition. Sufficient conditions of existence of an extreme of a functional.

Tensor calculus. Similar matrixes. Base of vector space. A matrix of transition in base to base. A linear operation and its matrix. A matrix of operation under transition of base. Determination of an eigenvalue and an eigenvector of a linear operation. A tensor of rank one and a tensor of rank two. An inertia tensor. An eigenvalue and an eigenvector of an inertia tensor. Invariants of transition of base of an inertia tensor. Tensor quadric, canonical form of tensor quadric and its application.

Orthogonal siquences and series. Fourier series. Trigonometrical Fourier series. Dirichlet conditions. Trigonometrical Fourier series for even and uneven functions. An application of Fourier series to solving of partial differential equations.

Operator methods. Laplace and Fourier transform. Fundamental properties of Laplace and Fourier transform. Convolution of functions. Borel theorem. An application of operator methods to solving partial differential equations.

Objectives:

- knowledge of formulating standard initial-value problem,
- boundary value problem,
- mastering fundamentals of tensor calculus.

Recommended literature:

1. Bateman H.: *Tables of integral Transforms*. McGraw-Hill Book Company.
2. Evans L.C.: *Partial Differential Equations* AMS.
3. Gelfand I.M., Fomin S.W.: *Rachunek wariacyjny*. PWN.
4. Krasnov M.I., Makarenko G.I., Kiselev A.I.: *Problems and exercises in the calculus of variations*. Mir Publishers.
5. McConnel A.J.: *Application of tensor analysis*. Dover Publications Inc.
6. Mieloszyk E.: *Nieklasyczny rachunek operatorów w zastosowaniu do uogólnionych układów dynamicznych*. Wyd. PAN.
7. Thomson W.T.: *Theory of Vibrations*. Unwin Hyman.

Code: **BSD002** **THEORY OF ELASTICITY AND PLASTICITY**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr inż. Marek Skowronek
dr hab. inż. Wojciech Witkowski</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 5</td></tr>
<tr><td>30</td><td>30</td><td></td><td></td><td></td><td>Assessment: exam</td></tr>
<tr><td colspan="7">Topics: Preliminaries. Assumptions and scope of theory of elasticity. Tensor calculus, Cartesian tensors, tensor algebra, differential operators, integral theorems. Plane stress and plane strain. Airy function in plane stress, plane stress solutions in Cartesian and polar coordinates. Kinematics of continuum, deformation tensors and strain tensors, compatibility conditions. Stress state, Cauchy stress tensor. Balance principles in the theory of elasticity, groups of equations in the theory of elasticity. Constitutive laws, linearly elastic material, generalized Hooke's law, Lame and engineering constants, hyperelastic materials. Strong formulation of the boundary problem, remarks on weak formulation. Theory of thin elastic plates, kinematic assumptions, stresses and strains, equilibrium of a plate, boundary conditions, rectangular and circular plates – examples, plate strips. Elements of theory of plasticity.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• describe the elastic and elastic-perfectly plastic behaviour of 2D plane stress systems and plates at bending,
• analyse the perfectly plastic limit states,
• formulate the boundary problem for typical 2D plane stress systems and plates at bending.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Holzapfel G.: Nonlinear Solid Mechanics. A continuum approach for engineers. John Wiley & Sons 2000.
2. Bielewicz E.: Strength of Materials. Politechnika Gdańska, Gdańsk 1992.
3. Fung Y.C.: Podstawy mechaniki ciała stałego. PWN Warszawa, 1969.
4. Girkmann K.: Dźwigary powierzchniowe. Arkady, Warszawa 1957 (tłumaczenie R. Dąbrowski).
5. Kączkowski Z.: Płyty – obliczenia statyczne. Arkady, Warszawa 1980.
6. Kmiecik M., Wizmur M., Bielewicz E.: Analiza nieliniowa tarcz i płyt. Politechnika Gdańska, Gdańsk 1995.
7. Kreja I.: Continuum Mechanics. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk.</td></tr>
</table>

Code: **BSD003** **COMPLEX CONCRETE STRUCTURES**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Jacek Tejchman</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Fundamentals of Building and Material Engineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 4</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics:
Concrete under static and dynamic loading. Creep and shrinkage of concrete. Steel reinforcement. Concrete with steel fibres. Reinforced concrete under bending and shearing. Reinforced concrete under eccentric compression. Dimensioning of reinforced concrete slabs, walls, frames, columns and foundations. Frame systems. Slab-column systems. Retaining walls. Application of FEM to reinforced concrete structures.</td></tr>
<tr><td colspan="7">Objectives:
• knowledge on construction, dimensioning and design of reinforced concrete structures.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Łapko A., Jensen B.C.: Bases of Design and Algorithms for Reinforced Concrete Structures. Arkady, Warszawa.
2. Kobiak J., Stachurski, W.: Reinforced Concrete Structures. Arkady, Warszawa.
3. Starolski W.: Reinforced Concrete Structures. Wydawnictwo Naukowe PWN.</td></tr>
</table>

Code: **BSD004** **COMPLEX STEEL STRUCTURES**

<table>
<tr><td colspan="6">Field of study: Civil Engineering
Postgraduate studies (MSc – course)</td><td>Responsible Persons:
dr inż. Aleksander Perliński
prof. dr hab. inż. Robert Jankowski
dr hab. inż. Piotr Iwicki, prof. PG</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Steel Structures and Construction Management
Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 4</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Welded cylindrical tanks. Vertical cylindrical tanks with fixed roofs. Tanks situated on the ground and underground tanks. Design of floating roofs and covers, loading, bottom and shell design, equipment. Structural design of bins. Method of analysis of multi-storey frames. Anatomy of multi-storey buildings. Tall buildings design – examples. Chimneys, lattice towers and masts – types, design and structure. Space trusses, space structures systems, the space structures connections. Steel structures refurbishments.</td></tr>
<tr><td colspan="7">Objectives:
• knowledge on steel structural systems.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Łubiński M., Żółtowski W.: Steel Structures. Part II. Arkady, Warszawa 2004.
2. Kucharczuk, W.: Steel halls and multi-storey buildings. Wydawnictwa Politechniki Częstochowskiej, Częstochowa 2004.
3. Rykaluk K.: Steel structures. Chimneys, towers, masts. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.
4. Ziółko J.: Zbiorniki metalowe na ciecze i gazy. Arkady, Warszawa 1986.
5. Bródka J., Kozłowski A.: Stalowe budynki szkieletowe. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2003.</td></tr>
</table>

Code: **BSD005** **CONSTRUCTION MANAGEMENT**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
mgr inż. Magdalena Pawelska-Mazur</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Concrete Structure and Technology of Concrete</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 6</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td></td><td></td><td>Assessment: exam</td></tr>
<tr><td colspan="7">Topics: Research of the best technological and logistic solutions. Decision making methods. Risk analysis for construction. Time table analysis. Power and material rates in construction. Intelligent management systems. Production processes. Operational management in civil engineering.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• analyse different technological and logistic solutions,
• do the risk analysis,
• manage the construction process.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Kowalczyk Z.: Mathematical Methods in Construction Management. Wydawnictwo Politechniki Gdańskiej. Gdańsk 1982.
2. Kowalczyk Z.: J. Zabielski: Kosztorysowanie i normowanie w budownictwie, WSiP, Warszawa 2005.
3. Jaworski K.M.: Podstawy organizacji budowy, PWN Warszawa 2004.
4. Jaworski K.M.: Metodologia projektowania realizacji budowy, PWN Warszawa 1999.
5. Pritchard C.L.: Zarządzanie ryzykiem w projektach. Teoria i praktyka. Management Training & Development Center, WIG-PRESS, Warszawa 2002.
6. Praca zbiorowa pod red. E. Ignasiaka: Badania operacyjne, PWE, Warszawa 2001.</td></tr>
</table>

Code: **BSD006** **ADVANCED FOUNDATIONS**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Kazimierz Gwizdała</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Geotechnics, Geology and Maritime Engineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 2</td></tr>
<tr><td>15</td><td></td><td>15</td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Geotechnical design, geotechnical categories, geotechnical design methods. Foundations on the elastic bed, generalized Winkler model. Stress distribution under shallow foundations for $e_B \neq 0$, $e_L \neq 0$. Bearing capacity of shallow foundations, Polish regulations, Eurocode 7. Piled foundations – actual engineering solutions and static testing of the bearing capacity. Deep foundations, technologies, basic static schemes, calculations. Refurbishment and renovation of existing foundations.</td></tr>
<tr><td colspan="7">Objectives: After the course students will be familiar with advanced methods of design and calculations of the shallow foundations, piled foundations and retaining structures. Parallelly they will learn some operational aspects in geotechnical engineering basing on the practical case histories.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Wiłun Z.: Outline of geotechnics, WKŁ, Warszawa
2. Dembicki E. i inni: Fundamentowanie, t. I i II" Arkady, Warszawa 1988
3. Jarominiak: Lekkie konstrukcje oporowe. WKŁ, Warszawa 2000.
4. Kobiak J., Stachurski W.: Konstrukcje żelbetowe. Arkady, Warszawa 1989
5. Gwizdała K., Kowalski J.R. (2005). Prefabrykowane pale wbijane, Monografia, Politechnika Gdańska, Gdańsk 2005.
6. Fundamenty palowe i specjalne (2004). Seminarium, IBDiM, Warszawa.
7. Fleming W.G.K., Weltman A.J., Randolph M.F., Elson W.K.: Piling Engineering, Blackie A&P / John Wiley & Sons, 1992.
8. Gwizdała K., Jacobsen M.: Bearing capacity and settlements of piles. Aalborg University, Denmark, 1992.
9. Czasopisma n-t „Inżynieria Morska i Geotechnika"
10. Czasopisma n-t „Inżynieria i Budownictwo"
11. Czasopisma n-t „Geoinżynieria i Tunelowanie

Standards:
• PN-83/B-03010 Ściany oporowe. Obliczenia statyczne i projektowanie.
• PN-83/B-02482 Fundamenty budowlane. Nośność pali i fundamentów palowych.
• EN 1997-1:2004, Eurocode 7. Geotechnical design. General rules.
• PN-EN 12699:2002 Execution of special geotechnical works – displacement piles.
• PN-EN 1536:2001 Execution of special geotechnical works. Bored Piles.</td></tr>
</table>

Code: **BSD008** **HYDRO AND MARINE CIVIL ENGINEERING**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr hab. inż. Waldemar Magda
dr inż. Witold Sterpejkowicz - Wersocki</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Geotechnics, Geology and Maritime Engineering
Department of Hydroengineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>Lab</td><td>sem</td><td>ECTS Points: 2</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Water resources – national and international. The handling of flood waters. Dams. Discharge and withdrawal plants. Weirs. Uncontrolled spillways, gated spillways, spillway chutes, energy dissipation. Waterways, locks. Power plants. Scope of Marine Civil Engineering. Construction of breakwaters.. Design of rubble mound and monolithic type breakwaters. Construction types of quay walls. Design of quay walls.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• describe basic structures of the hydro-engineering and marine civil engineering,
• select a proper type of structure with respect to given water depth, wave and geotechnical conditions,
• define and compute forces acting on the structure due to environmental loading conditions,
• perform stability analysis and check some basic stability conditions for the structure under design.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Roberson J.A., Cassidy J.J., M. Chaudhry H.: Hydraulic Engineering, Wiley, 1998.
2. Prasuhn A.L.: Fundamentals of Hydraulic Engineering, Oxford University Press, USA, 1995.
3. Novak P.: Hydraulic Structures, Routledge, 2006.
4. Depczynski W., Szamowski A., Budowle i zbiorniki wodne, Oficyna PWN 1999.
5. Budownictwo Betonowe t. XVII , praca zbiorowa pod redakcją Prof. W. Balcerskiego ARKADY 1969.
6. Hueckel S.: Budownictwo morskie, tom I, II, III i IV. Wydawnictwo Morskie, Gdańsk 1972.
7. Mazurkiewicz B.: Morskie budowle hydrotechniczne. Politechnika Gdańska, Gdańsk 1987.
8. Mazurkiewicz B.: Encyklopedia inżynierii morskiej. Wydawnictwo Morskie, Gdańsk 1986.
9. Poradnik hydrotechnika. Praca zbiorowa pod red. S. Massela. Wydawnictwo Morskie, Gdańsk 1992.
10. Morskie budowle hydrotechniczne. Zalecenia do projektowania i wykonywania Z 1 – Z45. Praca zbiorowa pod red. B. Mazurkiewicza. Fundacja Promocji Przemysłu Okrętowego i Gospodarki Morskiej, Gdańsk 2006.
11. Handbook Quay Walls. CUR: Centre for Civil Engineering Research and Codes, Public Works Rotterdam, Port of Rotterdam. Taylor & Francis, Gouda, The Netherlands, September 2005.</td></tr>
</table>

Code**: BSD017** **HYDRAULICS AND HYDROLOGY**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible person:
dr hab. inż. Michał Szydłowski, prof. PG</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Departament of Hydroengineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 1</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester:</td><td>Lec.</td><td>Tut.</td><td>Proj.</td><td>Lab.</td><td>Sem.</td><td>ECTS Points: 2</td></tr>
<tr><td>15</td><td>15</td><td></td><td>15</td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Basic hydrological processes in catchment. Infiltration, effective run-off. Open channel steady and unsteady flow. Hydrologic statistics, fitting distributions, extreme value distributions. Unsteady flow in pressure conduits – water hammer.</td></tr>
<tr><td colspan="7">Objectives: Students should master the following capacities:
• analysis of hydrological processes in catchment,
• determination of open-channel hydraulic parameters, oriented towards problems of hydroengineering,
• hydraulic description of unsteady phenomena in pressure conduits.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Byczkowski A.: Hydrology, Vol. 1, Vol. 2, SGGW Warszawa 1996.
2. Czetwertyński E., Utrysko B.: Hydraulika i hydromechanika, PWN Warszawa 1986
3. Eagleson P.S.: Hydrologia dynamiczna, PWN Warszawa 1978
4. Kubrak J.: Hydraulika techniczna, SGGW Warszawa 1998.
5. Mitosek M.: Mechnika plynów w inżynierii środowiska, Wydawnictwo Naukowe PWN Warszawa, 2001.
6. Sawicki J.: Przepływy ze swobodna powierzchnia, PWN Warszawa 1998.
7. Szymkiewicz R.: Modelowanie matematyczne przepływów w rzekach i kanałach, Wydawnictwo Naukowe PWN Warszawa, 2000.
8. Ozga-Zielińska M., Brzeziński J.: Hydrologia stosowana, Wydawnictwo Naukowe PWN Warszawa,1994.</td></tr>
</table>

Code: **BSD134** **FINITE ELEMENT METHOD**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
dr hab. inż. Wojciech Witkowski</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 4</td></tr>
<tr><td>30</td><td></td><td></td><td>30</td><td></td><td>Assessment: exam</td></tr>
<tr><td colspan="7">Topics: Strong and weak formulation of initial-boundary value problem (IBVP) of linear elasticity - revision. Triangular and quadrilateral plate elements within the framework of Kirchhoff-Love and first order shear deformation theory. Locking effect and means to overcome it: reduced integration, spurious zero-energy forms control, mixed formulations, assumed strain formulations. Analysis of eigenvalue problem of linear dynamics. Consistent and lumped mass matrix, Lobatto integration. Time integration schemes. Linear stability analysis. Nonlinear formulation of IBVP, finite element approximation, element matrices. Linearization and incremental iterative procedure. Convergence criteria. Remarks on alternative discretization methods.</td></tr>
<tr><td colspan="7">Objectives: Understanding FEM in context of surface structures. Ability to perform linear dynamics analysis of complex engineering structure. Understanding the linear stability analysis. Understanding the numerical aspects of nonlinear analysis.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Rakowski G., Kacprzyk Z.: Finite Element Method in Structural Mechanics. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.
2. Kleiber M.: Wprowadzenie do metody elementów skończonych. PAN-IPPT, Biblioteka Mechaniki Stosowanej, Warszawa - Poznań, PWN 1989.
3. Rakowski G.: Metoda elementów skończonych. Wybrane zagadnienia. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996.
4. Zienkiewicz O.C.: Metoda elementów skończonych. Arkady 1972.
5. Fung Y.C.: Podstawy mechaniki ciała stałego. PWN Warszawa, 1969, lub oryginał angielski
6. Kreja I.: Mechanika Ośrodków Ciągłych. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk 2003</td></tr>
</table>

Code: **BSD032** **WIND AND EARTHQUAKE ENGINEERING**

<table>
<tr><td colspan="6">Field of study: Civil Engineering
Postgraduate studies (MSc – course)</td><td>Responsible Persons:
prof. dr hab. inż. Krzysztof Wilde
prof. dr hab. inż. Robert Jankowski</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures
Department of Steel Structures and Construction Management</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Atmospheric motion (general circulation, wind velocity profiles, atmospheric turbulence, extreme winds climatology). Navier Stockes Equation. Flow over sharp edge objects. Flow over circular cylinder. Aeroelastic phenomena. Wind tunnel experiments. Wind actions on structures. Causes of earthquakes. Magnitude, intensity and other parameters of a ground motion. Historical earthquakes. Earthquakes in Poland. Seismic hazard maps. Types of structural damage due to ground motions. Dynamics of structures under earthquake excitation. Response spectrum. Experimental tests. Seismic resistant design. Geotechnical aspects. Rockburst induced ground motions.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• understand wind and earthquake effects on structures,
• design the wind and seismic resistant structures,
• conduct numerical analysis of structural response under wind and earthquake excitation.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Chopra A.K.: Dynamics of Structures: Theory and Applications to Earthquake Engineering. Englewood Cliffs, USA: Prentice-Hall 1995.
2. Simiu E., Scanlan R.: Wind Effects on Structures: John Wiley and Sons 1996.
3. Wiegel R.L.: Earthquake Engineering. Englewood Cliffs, USA: Prentice-Hall 1970.
4. Chen W.F., Scawthorn C.: Earthquake Engineering Handbook. Boca Raton, USA: CRC Press 2003.
5. Chmielewski T., Zembaty Z.: Podstawy dynamiki budowli. Warszawa: Arkady 1998.
6. Flaga A., Inżynieria wiatrowa podstawy i zastosowania: Arkady, 2008 (supplementary literature).</td></tr>
</table>

Code: **BSP055** **ENGINEERING SURVEYING**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr inż. arch. Dominika Wróblewska</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Geodesy</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>15</td><td></td><td>15</td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Introduction to topographic surveys: methods and instruments. Advanced geodetic surveying, precise monitoring methods in civil engineering and construction. Local, global, horizontal and vertical datum systems. Coordinates, projections and transformation. Global Navigation Satellite Systems (GPS, Glonass, Galileo): architecture, functions, precise measurement techiques, geodetic receivers and its application in engineering surveying. Active Geodetic Networks, ASG-EUPOS: architecture, networking structure, functions, services, data processing. Geodetic Laser Scanning: idea, measurements, instruments, data processing. Bathymetric surveys: methods, idea, instruments, data acquisition and processing. Integrated Engineering Geodesy Surveys: structure monitoring, movements of constructions, analysys, practical solutions. Data teletransmission systems in engineering surveying: digital and analog emission, binary transmission, ASCII codes. Fundamentals of GIS.</td></tr>
<tr><td colspan="7">Objectives:
understand advanced engineering surveying methods and its possibilities,
use selected surveying instruments and applying them form measurements,
ability to interpret and use surveying results in civil engineering practice,
geodetic instrument accuracy determination.</td></tr>
<tr><td colspan="7">Recommended literature:
Crowford W. G.: Construction Surveying and Layout, Publishing Inc., 2003.
Łyszkowicz A., Łyszkowicz S.: Surveying, Oficyna Wydawnicza Politechniki Warszawskiej, 2010.
Department of the US Army: Engineering and Design NAVSTAR Global Positioning System Surveying, US Department of Defence, 2003 (available in internet).
International Hydrographic Organization, Manual oh Hydrography, Monaco, 2005. (available in internet).
Illinois Department of Transportation Burea of Design and Environmental: Surveying Manual, 2003. (available in internet).
Wahr J.: Geodesy and Gravity, Samizdat Press, 1996 (available in internet).
Bossy J., Graszka W., Leonczyk M.: ASG-EUPOS The Polish Contribution to the EUPOS Project, Symposium on GNSS, 2008 (available in internet).</td></tr>
</table>

Code: **BSD135** **RELIABILITY OF STRUCTURES**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr hab. inż. Jarosław Górski, prof. PG
dr inż. Marek Skowronek</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td><td></td><td>Assessment: test</td></tr>
</table>

Topics: Probability theory - preliminaries. Probabilistic models for load and resistance variables. Basic definitions - reliability, failure probability. Random modelling of load and resistance variables. Reliability of structural systems. Levels of reliability methods – classification. Level I methods - application to standards and codes, partial safety factors. Level II methods – safety indices. Level III method - numerical procedures. Monte Carlo simulation, engineering examples. Random load combination. Time-variant reliability analysis.

Objectives: At the conclusion of the course, students should be able to:

- distinguish the basic methods to assess the reliability of structural systems,
- understand the probabilistic methodology of building codes and standards.

Recommended literature:

1. Ang A. H-S., Tang W.H.: *Probability concepts in engineering*. Wiley Chichester 2007.
2. Augusti G., Baratta A., Casciati F.: *Probabilistic methods in structural engineering*. Chapman & Hall, London 1984.
3. Ditlevsen O., Madsen H.: *Structural reliability methods*. Wiley Chichester 1996.
4. www.mek/dtu.dk/staff.od/books.htm
5. Hart G.: *Uncertainty analysis of loads and safety in structural engineering*. Prentice Hall Englewood Cliffs 1982.
6. Madsen H.O., Krenk S., Lind N.C.: *Methods of structural safety*. Prentice Hall Englewood Cliffs 1986.
7. Nowak A. Collins K.: *Reliability of structures*. McGraw Hill New York 2000.
8. Melchers R.: *Structural reliability Analysis and prediction*. John Wiley Chichester 1999.
9. Thoft-Christensen P., Baker M.J.: *Structural reliability theory and its applications*. Springer Berlin 1982.
10. Thoft-Christensen P., Murotsu Y.: *Application of structural system reliability theory*. Springer Berlin 1986.

Code: **BSD136** **BRIDGE STRUCTURES**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr hab. inż. Krzysztof Żółtowski, prof. PG
dr inż. Marcin Abramski</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>30</td><td></td><td>15</td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Information about bridges, definitions. Classification of bridge construction. Pavements on road and rail bridge. Deck of road and rail bridge. Bridge supports, abutments, pillars, construction details. Principle methods of calculations. General types of steel bridges: beam, truss, box, arch, suspension, cable-stayed bridges. Composite bridges: cross sections, static schemas, types of steel-concrete connection, erection methods, principle methods of calculations. Concrete bridges: beam, plate, frame, arch, principle methods of calculations. Some equipments of bridge: bearings, joins, drainage. Tunnels : cross sections, erection methods.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• name parts of bridge structures and describe their functions,
• determine types of bridges,
• recognize structural elements of bridge and explain system of carrying the loads by them,
• design and dimension of bridge structures,
• recognize equipments of bridge and their role for the structure.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Wai-Fah Chen, Lian Duan: Bridge Engineering Handbook. CRC Press LLC 1999.
2. Czudek H., Radomski W.: Podstawy mostownictwa. PWN, Warszawa 1983.
3. Ryżyński A., Wołowicki W., Skarżewski J., Karlikowski J.: Mosty stalowe. PWN, Warszawa-Poznań, 1984.
4. Szelągowski F.: Mosty metalowe. WKiŁ, Warszawa 1966.
5. Szczygieł J.: Mosty z betonu zbrojonego i sprężonego. WKiŁ, Warszawa 1971.
6. Leonhardt F.: Podstawy budowy mostów betonowych. WKiŁ, Warszawa 1982.</td></tr>
</table>

Code: **BSD137** **TRANSPORTATION ENGINEERING**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr inż. Jacek Alenowicz
dr inż. Piotr Jaskuła
dr inż. Lech Michalski
dr inż. Andrzej Massel</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Road Engineering
Department of Railway Engineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>30</td><td></td><td></td><td>30</td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Geometric design of road. Intersections and interchanges. Earthworks. Embankments on soft foundations. Soil Stabilization. Road bases and subbases. Bituminous materials and mixes. Concrete pavements. Pavement design. Highway drainage. Overview of land transportation systems. Railway system and its elements. Essential elements of track structure. Principles of track geometry (horizontal curves, transitions, super elevation, vertical geometry). Turnouts. Various types of posts. Railway stations and their classification. Overview of control command systems. Principles of organization of rail passenger transport. Principles of organization of rail freight transport. Rules of railway traffic. Timetabling. Graphic timetables</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• conduct geometric design of road and pavement design,
• know technologies in road and rail construction.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Profilidis V.A: Railway engineering. Ashgate Publishing 2000.
2. Pachl J.: Railway timetable and traffic. Eurailpress 2008.
3. Wiłun Z.: Zarys geotechniki 1987, 1999.
4. Rolla S.: Badania materiałów i nawierzchni drogowych. 1984.
5. Błażejowski K., Styk S.: Technologia warstw asfaltowych. 2004.
6. Gaweł I., Kalabińska M., Piłat J.: Asfalty drogowe 2001.
7. Piłat J., Radziszewski P.: Nawierzchnie asfaltowe 2004.
8. Szydło A.: Nawierzchnie drogowe z betonu cementowego 2004.
9. Wesolowski A., Krzywosz Z., Brandyk T.: Geosyntetyki w konstrukcjach inżynierskich 2000.
10. Edel R.: Odwodnienie dróg 2000.
11. Bogdaniuk B., Massel A.: Podstawy transportu kolejowego. Wydawnictwo Politechniki Gdańskiej 1999.</td></tr>
</table>

Code**: BSD138** **GEOTECHNICS**

<table>
<tr><td colspan="6">Field of study: Civil Engineering
Postgraduate studies (MSc – course)</td><td>Responsible Persons:
dr hab. inż. Lech Bałachowski, prof. PG
dr hab. inż. Marcin Cudny</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Geotechnics, Geology and Maritime Engineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 5</td></tr>
<tr><td>45</td><td></td><td>30</td><td></td><td></td><td>Assessment: exam and tests</td></tr>
<tr><td colspan="7">Topics: Shear strength of soils – general rules concerning the application of the Coulomb-Mohr shear strength criterion (drained & undrained conditions, dilatancy). Soil stiffness at small and intermediate strains – stress and strain dependency of the stiffness. Consolidation of saturated soils under general conditions (Biot theory). Secondary consolidation of soils (creep and relaxation). Lateral earth pressure for different drainage conditions and soil deformation modes. Soil slope stability calculations. Advanced soil constitutive models in practice (Cam-clay, Hardening Soil). Shallow foundations on the elastic and elasto-plastic soil ground: routine calculations of bearing capacity and settlements with the PN and EC standards. Bearing capacity and settlements of pile foundations according to the PN and EC standards regarding new pile technologies. Calculation methods of pile foundations in complex structural systems – bending, lateral loading, influence of the soft layer, application of the p-y, t-z and q-z curves. Dynamic pile testing (PDA, DLT, SIT). Appplication of the finite element and finite difference methods in geotechnics. Deep excavations – calculation methods, statics and execution technologies. Foundation problems in the regions of earthquake activity, exccesive mining and in the presence of expansive soils. Foundations of wind power plants. In situ soil investigations in acquiring soil parameters and stratification profiles: pressuremeter, dilatometer, CPT & CPTU, seismic methods.</td></tr>
<tr><td colspan="7">Objectives: It is expected that after the course students will be able to find an appropriate geotechnical solution for the given practical problem and to calculate the deformation, bearing capacity and safety basing on the rules of the standard and advanced soil mechanics. This will include:
• design of shallow foundations, soil reinforcements, retaining structures, earth structures, deep excavations, combined pile-slab foundations,
• analysis of the soil ground behaviour with the application of the advanced soil constitutive models and numerical methods,
• evaluation of the soil ground suitability for different foundation technologies and estimation of the important material parameters for the basic and advanced analysis methods.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Duncan J.M., Wright S.G.: Soil Strength and Slope Stability. John Wiley & Sons, Inc., USA, 2005.
2. Fleming W.G.K., Weltman A.J., Randolph M.F., Elson W.K.: Piling Engineering, Blackie A&P / John Wiley & Sons, 1992.
3. Geotechnical Engineering Handbook:Editor: Urlich Smotczyk, Ernst & Sohn, Darmstadt 2002.
4. Glazer Z.: Mechanika gruntów, Wydawnictwa Geologiczne, Warszawa, 1985.
5. Helwany S.: Applied Soil Mechanics with Abaqus Applications. John Wiley & Sons, Inc., USA, 2007.
6. Material Models Manual – Plaxis version 8, Balkema, The Netherlands, 2006.
7. Terzaghi K., Peck R.B., Mesri G.: Soil Mechanics in Engineering Practice, John Wiley & Sons, USA, 1996.
8. Tomlinson M.J.: Pile Design and Construction Practice, E & FN Spon, 1994.
9. Wiłun Z.: Zarys geotechniki, Wydawnictwa Komunikacji i Łączności, Warszawa, 1987.</td></tr>
</table>

Code: **BPD020** **STRUCTURAL DYNAMICS**

<table>
<tr><td colspan="6">Field of study: Civil Engineering
Postgraduate studies (MSc – course)</td><td>Responsible Persons:
prof. dr hab. inż. Krzysztof Wilde
dr hab. inż. Magdalena Rucka</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Dynamic of structures. Influence of vibrations on engineering structures. Fourier analysis. Experimental modal analysis. Identification of dynamic parameters. Methods of reduction of vibrations. Examples of dynamic problems in engineering structures.</td></tr>
<tr><td colspan="7">Objectives: At the conclusion of the course, students should be able to:
• perform numerical simulations of structures under dynamic loads,
• possess knowledge on dynamic tests performed on structures.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Clough R.W., Penzien J.: Dynamics of structures. McGraw-Hill Inc. 1993.
2. Chopra A.K.: Dynamics of structures. Upper Saddle River, New Jersey: Prentice Hall 2001.
3. Rucka M., Wilde K.: Dynamika Budowli z przykładami w środowisku Matlab®. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2008.
4. Branicki C., Wizmur M.: Metody macierzowe w mechanice budowli i dynamika budowli. Wydawnictwo Politechniki Gdańskiej. Gdańsk 1980.
5. Kucharski T.: Systemy pomiarów drgań mechanicznych. Wydawnictwa Naukowo-Techniczne Warszawa 2002.
6. Lewandowski R.: Dynamika konstrukcji budowlanych. Wydawnictwo Politechniki Poznańskiej 2006.</td></tr>
</table>

Code**: BSD139** **SEMINAR ON CIVIL ENGINEERING**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Jacek Tejchman</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Fundamentals of Building and Material Engineering</td></tr>
<tr><td colspan="6">Year of study: I / Semester: 2</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>30</td><td>Assessment: attendance + topic presentation</td></tr>
<tr><td colspan="7">Topics: Presentation of diploma projects. Visiting building structures during their realisations. Preparation and presentation of building topics.</td></tr>
<tr><td colspan="7">Objectives: Preparation for defending diploma works.</td></tr>
<tr><td colspan="7">Recommended literature:
1. English building journals</td></tr>
</table>

Code: **BSD048** **FINITE ELEMENT METHOD - APPLICATIONS**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Paweł Kłosowski</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Structural Mechanics and Bridge Structures</td></tr>
<tr><td colspan="6">Year of study: II / Semester: 3</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>30</td><td>Assessment: presentation of selected problem</td></tr>
<tr><td colspan="7">Topics: Teaching of the advanced FEM programs usage of structural analysis. Ways of proper selection of the FEM computer system. Comparison of the systems' possibilities – estimation of their strong and weak sides. Unaided performance of the comparison analysis of a structure and validation of the obtained results.</td></tr>
<tr><td colspan="7">Objectives: To put a student au fait; with available advanced structure analysis systems – their advantages and drawbacks. Reaching ability of making the comparison analysis, validation of the results. Obtaining the results, presentation and discussion of their quality.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Manual of Robot Millenium (Robobat- AutoDESK) (avialable as PDF file).
2. Manual of NASTRAN system (avialable as PDF file).
3. Manual of MSC.MARC system (avialable as PDF file).</td></tr>
</table>

Code: : **BSD140** **GEOLOGY AND HYDROGEOLOGY**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Persons:
dr inż. Maria Przewłócka
dr inż. Beata Jaworska-Szulc</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Geotechnics, Geology and Maritime Engineering</td></tr>
<tr><td colspan="6">Year of study: II / Semester: 3</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 2</td></tr>
<tr><td>15</td><td></td><td></td><td>15</td><td></td><td>Assessment: test</td></tr>
<tr><td colspan="7">Topics: Geologic time, the Earth’s layers; plate tectonics theory; basic geological structures; geological processes; natural hazards (earthquakes, volcano eruptions, mass wasting); the rock cycle, the origin, recognition, description and utilisation of basic igneous, sedimentary and metamorfic rocks; landform development; fluvial, glacial and eolian processes; lithosphere as a source of natural resources; utilisation and protection of superficial deposits; human impact on the environment; groundwater occurrence – types of aquifers, gaining and losing streams; groundwater contour lines, hydrogeological cross- sections; aquifer characteristics; principles of groundwater flow; groundwater quality and protection;

Analysis of geological and hydrogeological data: maps, cross - sections, profiles, reports; study of geomorphological and hydrogeological features of different regions in Poland; drawing geological and hydrogeological cross-sections; drawing groundwater contour lines</td></tr>
<tr><td colspan="7">Objectives: The course broadens student’s understanding of Earth processes and materials, geological hazards; the influence of Earth processes on the Earth’s sculpture and composition. The course enables students to understand groundwater occurrence and the necessity of it’s protection. Student becomes acquainted with different kinds of geological and hydrogeological maps and is prepared to describe and analyse environmental conditions (geomorphological, geological and hydrogeological) of any region.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Thompson, Turk: Modern Physical Geology.
2. Press, Siever, Grotzinger, Jordan: Understanding Earth.
3. Finkl C.W: The Encyclopedia of Applied Geology.
4. Bell F.G.: Environmental Geology Principles and Practise.
5. Żyłka R.: Geological Dictionary.
6. Domenico P.A., Schwartz F.W.: Physical and Chemical Hydrogeology.
7. Fetter C.W.: Applied Hydrogeology.
8. Kleczkowski A.S., Różkowski A.: Słownik hydrogeologiczny.</td></tr>
</table>

Code**: BSD141** **THESIS SEMINAR**

<table>
<tr><td colspan="6">Field of study: Civil Engineering</td><td rowspan="2">Responsible Person:
prof. dr hab. inż. Robert Jankowski
dr inż. Mariusz Kembłowski, prof. PG</td></tr>
<tr><td colspan="6">Postgraduate studies (MSc – course)</td></tr>
<tr><td colspan="6">Full-time studies</td><td>Department of Steel Structures and Construction Management</td></tr>
<tr><td colspan="6">Year of study: II / Semester: 3</td><td>Language: English</td></tr>
<tr><td rowspan="2">Hours in semester</td><td>lec</td><td>tut</td><td>proj</td><td>lab</td><td>sem</td><td>ECTS Points: 3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>45</td><td>Assessment: presentation of report</td></tr>
<tr><td colspan="7">Topics: Layout and style of MSc thesis written in English. Presentations related to topics of diploma thesis. Active participation of students in seminars and in discussions on presented reports.</td></tr>
<tr><td colspan="7">Objectives: Learning of writing the MSc thesis in English, conducting the individual literature research, preparation of audio-visual presentations, public presentation and participation in discussions.</td></tr>
<tr><td colspan="7">Recommended literature:
1. Scientific journals
2. Technical books
3. Internet</td></tr>
</table>