Cracow University of Technology
Courses and Studies in English
Academic Year 2013/2014

Collected by Karolina Badocha, MA on the basis of information received from CUT faculties

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CONTENTS

OFFICIAL NAME IN POLISH: **POLITECHNIKA KRAKOWSKA**

Official name in English: Cracow University of Technology (CUT)

Address: 24 Warszawska Street, 31-155 Cracow, Poland

Webpage: http://www.pk.edu.pl

Faculties: Faculty of Architecture
Faculty of Physics, Mathematics and Computer Science
Faculty of Electrical and Computer Engineering
Faculty of Civil Engineering
Faculty of Environmental Engineering
Faculty of Chemical Engineering and Technology
Faculty of Mechanical Engineering

ERASMUS code: PL KRAKOW03

General description: Cracow University of Technology has been successfully educating engineers for over 60 years. Total number of alumni that graduated from our University exceeds 62 000. In May 2008 Cracow University of Technology was rated by the magazine Newsweek Poland as the best university in Poland according to employers who eagerly hire our alumni due to their high qualifications. In October 2010 our prestige was confirmed by honorary title „the University friendly for employers". Such a recognition proves that Cracow University of Technology offers attractive, high quality and tailor-made programmes of study responding to market needs. Our alumni find jobs at public and private companies, national and international enterprises, national and regional government administration, in design offices and also at universities and research institutes. Our Faculty of Architecture earned accreditation of the Royal Institute of British Architects, as well as it was claimed to be the best Faculty of Architecture in Poland . The Faculty of Civil Engineering educates future engineers at the top level and The Faculty of Mechanical Engineering is the second largest faculty of its kind in Poland. Different faculty members cooperate with the European Commission serving as experts and also with various companies and research institutes around the world. Cracow University of Technology signed 87 bilateral agreements and 265 Erasmus agreements that allow its students to experience studies abroad not only in countries of the European Union but also in the USA, Canada, Mexico and places as distant as Australia, Japan, Taiwan, Singapore or South Korea. International students are very welcome to our university.

Academic calendar: Fall Semester: October 1 - end of January; Spring Semester: mid February – end of June;
Exam Sessions: first two weeks of February and last two weeks of June

Registration procedure: Please refer to http://www.bwm.pk.edu.pl

Health insurance: Basic medical care is available at a reduced charge at the CUT Medical Centre in Warszawska Street. Responsibility for full insurance lies with the student.

Accommodation: The Cracow University of Technology has at its disposal about 2200 places in 4 student dormitories on the Czyżyny Campus. International students are offered accommodation in the CUT dormitories.

Sport facilities: The Physical Education and Recreational Centre at the Cracow University of Technology has its own sports facilities: two gyms, three body building clubs, an aerobics room, sport fields and tennis courts. Besides, the Centre has access to a skating rink and a swimming pool.

Leisure activities: Students of CUT have a number of possibilities of spending their leisure time actively. The facilities within the university are: Students' Sport Association - University Club, Student Cultural Centre "Kwadrat", "Cantata" Academic Choir of the Cracow University of Technology, "Bawinek" Student Dancing Club, "Gil" Gallery, and "1 Kanonicza Street" Art Gallery and Dependent Theatre.

City description: Cracow is situated about 190 miles south of Warsaw, the capital of Poland, and about 70 miles north of the major skiing resort of Poland - Zakopane. Cracow is the city of culture and tradition, with numerous historic monuments. Its historic City Centre has been included in the UNESCO World Heritage List. The wealth of architectural monuments such as Wawel Castle, St. Mary's Basilica and Wit Stwosz Altar, the biggest Market Place (Rynek Główny) in Europe, the Cloth Hall (Sukiennice), works of art, charm of medieval streets, nooks and corners create the unforgettable, unique atmosphere of the Old Town. Cracow is one of the most important cultural cities in Europe with its famous theatres: the Słowacki Theatre and the Stary Theatre and museums such as the National Museum with great collection of Polish paintings, the Czartoryski Museum with The Lady with the Ermine by

Leonardo da Vinci, and many others. Cracow is also one of the oldest academic centres in Europe with over 190,000 students studying at twenty six universities and colleges.

COURSES OFFERED IN ENGLISH - FACULTY OF ARCHITECTURE 2013/14

PROGRAMME TENNESSEE

1. Urban Design International Programme – Programme Tennessee

LECTURES

2. Building Livable Cities I - Urban Housing Today and Tomorrow
3. Building Livable Cities II - Urban Spaces, Public Places
4. Urban Revitalization
5. Urban Transport – Theory
6. History of Polish Architecture
7. Urban Design Of City Centers – Theory

RESEARCH

8. Preservation of Monuments And Revalorization
9. Building Construction Systems + Building Surveying
10. Building Structures
11. Cad Techniques
12. Ecology And Environment Environmental Protection
13. Eco City

ARTISTIC SUBJECTS

14. Photography
15. Freehand Drawing and Painting
16. Freehand Drawing - Architectural Perspective Drawings
17. Freehand Drawing And Painting - Still Life Studies
18. Freehand Drawing – Painting and Composition
19. Freehand Drawing and Composition
20. Sculpture

PROJECTS/ DESIGNING
ARCHITECTURAL & URBAN DESIGN

21. Residential Buildings I – single family housing
22. Residential Buildings II – multifamily housing
23. Residential Building Design II - Architectural and Urban Design of Residential Complexes A
24. Residential Building Design II - Architectural and Urban Design of Multifamily HousingA
25. Residential Building Design II - Architectural and Urban Design of Multifamily HousingB
26. Residential Building Design II - Residential Infill in The Urban Fabric
27. Residential Building Design II - Architectural and Urban Design of Residential Complexes B
28. Residential Building Design II - Urban Infill
29. Service Complexes Design
30. Public Use Building Design I (advanced design)
31. Public Use Building Design II (Master Degree - advanced design)
32. Architectural Design of Service Buildings - Naturally Shaped Architecture (NSA 1&2)

33. Architecture Design of Public Buildings - Naturally Shaped Architecture (NSA 3) – advanced design
34. Architecture Design of Public Buildings - Naturally Shaped Architecture (NSA 4) – Master Degree Advanced Design
35. Architecture Design of Public Buildings - Naturally Shaped Architecture (NSA 5) - Diploma Design
36. Industrial Architectural Design
37. Spatial Planning A
38. Spatial Planning B
39. Design for Conservation
40. Architecture And Planning in the Countryside
41. Regional Planning
42. Multi-Family Housing Design
43. Multi-Family Housing Design - Architectural and Urban Design of Multifamily Residential Complexes A
44. Multi-Family Housing Design - Architectural and Urban Design of Multifamily Residential Complexes B
45. Multi-Family Housing Design - Architectural and Urban Design of Residential Complex
46. Urban Design A
47. Urban Design B
48. Urban Design - Centers and Central Areas
49. Urban Design C
50. Urban Design D
51. Urban Design - Redevelopment of a Part of a City with Prevalent Service Function
52. Urban Design of Service Areas
53. Urban Design of City Centers A
54. Urban Design of City Centers B
55. Urban Design Of City Centers C
56. Urban Design Of City Centers D
57. Urban Design of City Centers E
58. Urban Design of City Centers - Urban Renewal A
59. Urban Design Of City Centers - Urban Renewal B
60. Special Design Topics. Design Studies: The Search for an Architectural Pretext
61. Special Design Topic: Design Studies of Form, Function And Structure
62. Special Design Topic: Urban Design A
63. Special Design Topic: Urban Design B
64. Special Design Topics: Urban and Environmental Protection
65. Special Design Topics: Town, Spatial And Regional Planning, Spa and Health Resorts Planning

PROJECTS/ DESIGNING
LANDSCAPE ARCHITECTURE DESIGN – INTEGRATED DESIGN STUDIOS

66. IDS 2 - Private Garden
67. IDS 3 - Urban Public Space (street & square)
68. IDS 4 - Revalorization of Historic Gardens
69. IDS 5 - Public Park
70. IDS 6 - Post – industrial areas
71. IDS 7 - Composition in Open Landscape

72. IDS 8 - Physical Planning
73. IDS 9 - Physical Planning – Plans of protection

COURSE TITLE: **URBAN DESIGN INTERNATIONAL PROGRAMME – PROGRAMME TENNESSEE**

Erasmus subject code: 02.0

Duration: 1 semester (Spring Semester)

ECTS credits: 30 (European system)

Programme description: The Faculty of Architecture through its International Programme offers an opportunity to study Architecture and Urban Design within the inspiring context of a European City. The full-time semester programme, has been tailored to suit students in Architecture at the 3rd to 5th year level, who wish to broaden their experience studying abroad for one semester.

The International Programme has a long tradition, started in 1992. Its major components has been an exchange with the University of Tennessee, United States, from which a group of 15-20 students come each year to spend the Spring Semester in Cracow.

The main component of the programme is Design Studio (15 hours a week) focusing on creating new architecture sited within historic urban context. The project breaks up into three clearly defined stages: Urban Analysis, Urban Design and Architectural Design. The Design Studio is supported by subjects in Theory and History of Architecture, Theory of Urban Design, Drawing, Painting and Sculpture where students can explore issues relevant to their design assignment.

Trips through Europe and Poland provide an opportunity to experience firsthand the best of the heritage and contemporary architecture of the region. An organized nine-day-study trip to European Centers may include: Vienna, Prague, Venice, Florence, Padua, Berlin, etc.

A six-day-trip through Poland explores historic towns, castles, palaces, cathedrals, monasteries and other historic structures and landscapes. (Study trips incurs additional fees). In their free time students are encouraged to visit other places of professional interest both in Poland and in the broader region.

Eligibility/Admission: 3rd to 5th year level architecture students within exchange programme Tennessee or as fee paying students from other universities

Contact person: Krzysztof Bojanowski, PhD Arch.,
phone #: +48 12 628-31-13
e-mail: kbojanowski@poczta.fm

LECTURES

COURSE TITLE: **LECTURES: BUILDING LIVABLE CITIES - URBAN HOUSING TODAY AND TOMMOROW**

Institute/Division: A3 - Institute of Urban Design, Division of Public Spaces for Movement

Erasmus subject code: 02.0

Number of contact hours: 15

Course duration: 1 semester (Fall)

ECTS credits: 5

Course description: Lectures are focused on the following themes:

- historical development of residential fabric in cities;
- different approaches to the housing problems in the 20th century;
- residential density and other urban factors allowing evaluation of different housing proposals;
- family needs and surface area standards of the apartments;
- residential buildings – the typology of access, the typology of layout;
- spaces between buildings;
- privileged groups in the residential complexes – children, handicapped, elderly people;
- current trends in designing of urban multi-family housing – city block or block of flats?
- new relations *house - place of work* in cities of information civilization.

Literature: Basic literature on urban rehabilitation and design of residential complexes:

- *International Building Exhibition Berlin 1987*, Rizzoli, New York 1986;
- *International Building Exhibition Berlin 1987*, “Architecture and Urbanism” – Extra Edition, 5/1987;
- Mozas Javier, Fernandez Per Aurora, Density, New Collective Housing, a+t ediciones, 2004;
- Schneider Friederike – editor, Floor Plan Manual – Housing, Brikhäuser – Publishers for Architecture, Berlin 2004;
- + architectural periodicals.

Course type: Lectures

Assessment method: Attendance and evaluation of the final submissions (critical essay)

Primary target group: 3rd, 4th and 5th year students in Architecture

Lecturer: Anna Palej, Assoc. Prof. DSc PhD Arch.
Contact person: Anna Palej, Assoc. Prof. DSc PhD Arch., phone #: +48 12 628-31-13;
e-mail: annapalej@gmail.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **LECTURES: BUILDING LIVABLE CITIES II - URBAN SPACES, PUBLIC PLACES**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Erasmus subject code: 02.0

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 5

Course description: Lectures are focused on complex problems of urban design of contemporary city centres. Discussed themes are the following:

- contemporary spatial problems of cities and their historical background;
- different approaches to urban design in the 20th c.;
- historical paradigms and their application in contemporary urban design practice;
- urban analysis – chosen concepts;
- factors influence high standard of living in cities: quality of public spaces, residential fabric, and green open spaces;
- “great streets” and their contemporary role in the city;
- “third places”;
- presentation of various possibilities, values and chances that develop under the influence of information technology;
- future of urban life – utopian visions and image of cities shaped by the new economy;
- searching for new urban ethics.

Literature: Basic literature on the subject of urban design and urban rehabilitation to be given at the beginning of the course.

Course type: Lectures

Assessment method: Attendance and evaluation of the final submissions (critical essay or 15 min. PowerPoint presentation)

Primary target group: 3rd, 4th and 5th year students in Architecture

Lecturer: Anna Palej, Assoc. Prof. DSc PhD Arch.

Contact person: Anna Palej, Assoc. Prof. DSc PhD Arch.,
phone #: +48 12 628-31-13;
e-mail: annapalej@gmail.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **LECTURES & SEMINARS: URBAN REVITALIZATION**

Institute/Division: A5 - Institute of Urban and Regional Planning and Design

Erasmus subject code: 02.1 / 02.3 / 02.4
Number of contact hours: 15
Course duration: 1 semester (Fall)
ECTS credits: 3

Course description: The course's goal is to develop the ability to analyze specific project related to urban revitalization strategies in the context of spatial policy documents for a given city. The course traces interrelations between urban decline and public / private strategies, projects and actions taken to revitalize inner cities with particular reference to the post industrial areas and close-to-station areas. Focus is put on urban revitalization projects combined with the redevelopment of city centres in major metropolitan areas in EU.
Major issues: Doctrinal and strategic framework for revitalization programs and projects. Case studies of selected "flagship projects". Comparative analysis; assessment criteria. Specific revitalization projects in the city of Cracow at the background of spatial policy documents.

Literature:

- Bianchini F. and Parkinson M. (eds.), 1993, Cultural Policy and Urban Regeneration: The West European Experience, Manchester University Press, Manchester and New York.
- Chatterji M., R. Domański, (editors), Urban and Regional Management in Countries in Transition; Polish academy of Sciences, Warsaw 1996
- Lorens P., (editor), Large Scale Urban Developments, Technical University of Gdansk Publishing Gdansk 2001
- Zuziak Z., Managing Historic Cities, International Cultural Centre Cracow, Cracow 1993

Course type: Lectures and seminars

Assessment method: Attendance and the paper (case study regarded as written exam) presented during the course

Prerequisites: Basic course on urban design and planning

Primary target group: 4th and 5th year students in Architecture and Urban Planning

Lecturer: Zbigniew Zuziak, Prof. DSc PhD Arch.

Contact person: Zbigniew Zuziak, Prof. DSc PhD Arch.
e-mail: a5-institute@pk.edu.pl or zzuziak@nsnet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **LECTURES: URBAN TRANSPORT - THEORY**

Institute/Division: A3 - Institute of Urban Design, Division of Public Spaces for Movement

Course code: C2-7

Erasmus subject code: 02.3 / 02.6

Number of contact hours: 15 (lectures)

Course duration: 1 semester (Fall)

ECTS credits: 2

Course description: The course involves lectures on issues related to planning and design of networks and spaces for traffic and circulation in the cities. It deals with basic technical problems of urban transport, composition of relevant urban spaces, and generally interrelations of transport and urban design. The lecture topics include:

- transport issues and their role in planning and urban design;
- general characteristics of various transportation modes: tram, bus, rapid transit, car, bike, pedestrian movement, dual-mode systems, etc.;
- impact of transport technology on urban development and form;
- transport development strategies: role of public transport, impact of motorized traffic on urban environment, traffic calming concepts, transport demand management policies;
- street networks and street hierarchy in urban areas;
- street space composition, street as part of urban public space.

Literature:

- T.Pharoah, D.Apel: *Transport Concepts in European Cities* Ashgate, Aldershot 1995
- H. Frey: *Designing the City*, E&FN Spon, Londyn 1999
- P.Calthorpe, W. Fulton: *The Regional City*, Island Press, Washington 2000
- K. Bieda: *Street Space in the City not only for Automobiles* in: Public Space of Contemporary City, Conference Proceedings, Wydaw-nictwo Politechniki Krakowskiej, Cracow 2005
- B. Niels: *Design in Human Scale*, *or how to make sitters, bikers and drivers meet and feel comfortable*, in: Public Space of Contemporary City, Conference Proceedings, Wydawnictwo Politechniki Krakowskiej, Cracow 2005

Course type: Lectures

Assessment method: Written test

Primary target group: 3rd year students in Architecture

Lecturer: Krzysztof Bieda, Prof. DSc PhD Arch.

Contact person: Krzysztof Bieda, Prof. DSc PhD Arch.,
phone #: +48 12 628-24-29;
e-mail: kbieda@pk.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **LECTURES- HISTORY OF POLISH ARCHITECTURE**

Institute/Division: A1- Institute of History of Architecture and Monument Preservation, Chair of History of Polish Architecture and Monument Preservation

Erasmus subject code: 02.9

Number of contact hours: 30

Course duration: 1 semester (Fall or Spring Semester)

ECTS credits: 3

Course description: This course investigates the theory and practice of Polish architecture from the end of 9th c. till the end of 20th c. based on examples located in Cracow. The students will examine general and local factors of development of architecture. It is intended to provide a understanding of general tendencies and local diversities in history of architecture. By visiting sites in Cracow the students will meet variety of historic architecture in Poland. The field case study method is mostly used for this examination.

Literature:

- Miłobędzki, Adam, The Architecture of Poland, MCK Cracow 1994;
- Ostrowski, Jan, Cracow, Cracow 1982;
- Zachwatowicz, Jan; Polish Architecture, Warsaw 1967.

Course type: Field seminars and lectures

Assessment method: Attendance and the final exam

Prerequisites: none

Primary target group: 3rd, 4th, and 5th year students in Architecture

Lecturer: Jacek Czubiński, PhD Arch.

Contact person: Jacek Czubiński, PhD Arch.,
phone #: +48 12 628-24-16; +48 503 035 289;
e-mail: jacek.czubinski@wp.pl

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule

COURSE TITLE: **LECTURES: URBAN DESIGN OF CITY CENTRES – THEORY**

Institute/Division: A3 - Institute of Urban Design; Division of Public Spaces for Movement

Course code: C4-2-1

Erasmus subject code: 02.3

Number of contact hours: 15

Course duration: 1 semester (Spring)

ECTS credits: 3

Course description: Lectures are focused on problems of contemporary changes of city areas and multi-functional centers design. Discussing this attention was drawn to the issue of communication and interaction as seen through sociological and psychological conditions but in reference to and in association with public space.
The lecture topics include:

- Spatial surroundings and human psyche - classification of effect conditions;
- The way we play' on public space as a stage of everyday life theatre - the role theory and the play theory by Irving Goffman;
- Form and meaning in architectural and urban composition - Juliusz Żórawski and Kazimierz Wejchert's theories;
- Sense of identity and its importance for cities and regions competitions.

Literature: Basic literature on urban design and urban renewal

Course type: Lectures

Assessment method: Attendance and evaluation of the final submissions (critical essay or 15 min. PowerPoint presentation)

Primary target group: 3rd & 4th year students in Architecture

Lecturer: Anna Franta, Assoc. Prof. DSc PhD Arch

Contact person: Anna Franta, Assoc. Prof. DSc PhD Arch.;
phone #: +48 12 628-24-70;
e-mail: studio_ut@pk.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **PRESERVATION OF MONUMENTS AND REVALORIZATION**

Institute/Division: Institute of History of Architecture and Monument Preservation, Chair of History of Polish Architecture and Monument Preservation

Course code: C1-4

Erasmus subject code: 02.9

Number of contact hours: 15 (seminars) + 15 (individual tutoring)

Course duration: 1 semester (Fall)

ECTS credits: 2 + 2

Course description: Conveying the essential areas of knowledge connected with the problems of monument preservation: the development of European theory and practice; regional particularities of the Polish lands; acquaintance with the methodologies and principles of conservation design and the technologies of preservation work.

Literature: Readings on theory of monuments preservation methodology and technical aspects.

Course type: Seminars + individual tutoring

Assessment method: Attendance and the evaluation of the final submission

Prerequisites: none

Primary target group: 3rd, 4th, and 5th year students in Architecture

Lecturer: Andrzej Kadłuczka, Prof. DSc PhD Arch. ,
Anna Białasik, PhD Arch.

Contact person: Anna Białasik, PhD Arch.,
phone #: +48 12 628-24-08; +48 600 312 236;
e-mail: bialasik@neostrada.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

Remarks: Seminars (2 ECTS) may accompany Design for Conservation in Spring semester

COURSE TITLE: **BUILDING CONSTRUCTION SYSTEMS (individual research)**

Institute/Division: A4 - Institute of Construction Design, Division of General Building Systems and Construction Materials

Erasmus subject code: 02.9
Number of contact hours: 30
Course duration: 1 semester (available in Fall and Spring Semester)
ECTS credits: 2 (minimum)

Course description: The task of this course is to help students to elaborate the alternatives of technical solutions of the most important details of their design work. Basic form of drawings – from freehand conceptual sketches to technical drawings.

Literature: Basic literature on technical solutions

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission

Prerequisites: Architectural Studio

Primary target group: 3rd and 4th year students in Architecture

Lecturer: Wacław Celadyn, Prof. DSc PhD Arch.

Tutor: Robert Marcinkowski, PhD Arch.

Contact person: Robert Marcinkowski, PhD Arch.,
phone #: +48 12 628-24-59;
e-mail: rob500@gazeta.pl

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule)

COURSE TITLE: **BUILDING SURVEYING (individual research)**

Institute/Division: A4 - Institute of Construction Design, Division of General Building Systems and Construction Materials

Erasmus subject code: 02.9

Number of contact hours: 30

Course duration: 1 semester (available in Fall and Spring Semester)

ECTS credits: 2 (minimum)

Course description: The task of this course is to help students to elaborate the alternatives of technical solutions of the most important details of their design work. Basic form of drawings – from freehand conceptual sketches to technical drawings.

Literature: Basic literature on technical solutions

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission

Prerequisites: Architectural Studio

Primary target group: 3rd and 4th year students in Architecture

Lecturer: Wacław Celadyn, Prof. DSc PhD Arch.

Tutor: Łukasz Wesołowski, MSc Arch.

Contact person: Robert Marcinkowski, PhD Arch.,
phone #: +48 12 628-24-59;
e-mail: rob500@gazeta.pl

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule)

COURSE TITLE: **BUILDING STRUCTURES**

Institute/Division: A4 Institute of Construction Design, Division of Building Techniques

Erasmus subject code: 02.9
Number of contact hours: 30
Course duration: 1 semester (available in Fall and Spring Semester)
ECTS credits: 2 (minimum)

Course description: The main goal of this course is to help students during their design work and connected with proper solutions combining together building function and structure. Student is obliged to select one topic among three main groups of tasks or she/he has right to propose another individual topic of the research, which is strictly within the basic teaching problems of this course. Students can work individually or in groups of maximum 3 persons. The first of the main topics refers to the comprehensive research of structural system of a chosen building including general aspects of stability, problems of structural design of component parts together with issues of assembly and maintenance of the whole building caused by application of the applied support system. The second one is connected with structural design of selected members of the bearing building structure together with the basic static calculations, structural drawings etc. The third kind of the main topics is to present the general and basic problems of various forms and types of structural systems, which may be applied as the support structures for the same type of objects, of the equal geometrical sizes and the same functional purposes. For this topic students have to prepare suitable static calculations and appropriate drawings. For all types of the main topics the final presentation done in Power Point is obligatory.

Literature: Basic literature on technical solutions in form of technical manuals, building codes, national and international journals in appropriate fields of engineering and architectonic issues.

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission

Prerequisites: Architectural Studio

Primary target group: 3rd and 4th year students in Architecture

Lecturer: Janusz Rębielak, Prof. DSc PhD Arch.

Contact person: Janusz Rębielak, Prof. DSc PhD, Arch.;
e-mail: jrebielak@wp.pl

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule)

COURSE TITLE: **CAD TECHNIQUES**

Institute/Division: A9 - Institute of Construction Design; Division of Descriptive Geometry, Technical Drawing and Engineering Graphics

Number of contact hours: 30

Course duration: 1 semester (Fall or Spring Semester)

ECTS credits: 4 (minimum)

Course description: Application of Computer Aided Design methods and techniques into practice. Includes techniques for creating 2D vector (AutoCAD) and raster (Photoshop, GIMP) graphics and 3D drawings, which are directly related to the real-world architectural structures.
New concepts of 3D architectural design and modeling with AutoCAD, AutoCAD Architecture, Revit, Mudbox, ArchiCAD, Blender, 3dsMax applications. Introduction of modern tools (Drawing Board, 3D printer) and methods (BIM, Graphisoft Virtual Building Solution for Teamwork, "working in the cloud") into design process: starting from a 3D modeling, through visualization (Artlantis), animation (ArchiCAD, 3dsMax Design, Artlantis) and Virtual Reality (BIMX) into technical layouts, cross sections and dimensioning creation (blueprints).

Literature: Basic literature on Graphics, CAD, Geometry and Technical Drawing

Course type: Computer laboratory: individual design work

Assessment method: Evaluation of all design assignments

Prerequisites: Basic knowledge on the architectural design, basic ICT skills

Primary target group: All level students in Architecture and Landscape Architecture

Lecturer: Marek Cyunel, MSc Arch.

Contact person: Marek Cyunel, MSc Arch. ;
phone #: +48 12 628 29 92 or +48 602 678 044;
e-mail: mcyunel@usk.pk.edu.pl, mcyunel@gmail.com

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule

COURSE TITLE: **ECOLOGY AND ENVIRONMENT ENVIRONMENTAL PROTECTION**

Institute/Division: A5 - Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Number of contact hours: 30

Course duration: 1 semester (Fall)

ECTS credit: 3

Course description: Lectures present knowledge on the activities aimed at balancing the development, being the basis for shaping the conditions of human life in urbanized areas. The questions presented concern the connections between the manner of managing space with environmental quality, the manner of limiting the impacts of improper management of natural resources, methodology of assessing the environmental impact of a development (EIA), and the influence of the idea of conservation of the natural environment on the shaping of planning and architectural assumptions.

The seminars deal with learning the influence of various development activity on the transformations of individual components of the environment and ways of countering them.

Students learn the methods of analyzing the environment and identification of determinants of the ecological & physical geographic type, and are given an opportunity to consider the environmental impact of individual developments in specific locations

The subjects and manners of conducting the seminars change every year.

The classes conducted should bring about the ability to assess the influence of planning and implementation activities on the existing environment, and methods of balancing development through protection of the values and rational asset management.

Literature: Basic literature on the subject of urban design and ecology and e.g.

- Banham R., The Architecture of Well tempered Environment 1969-1984 . Detail 6/2002
- Barreneche R., Buildings under Power, Architecture 5/ 2000
- Directive Of The European Parliament And Of The Council On The Promotion Of The Use Of Energy From Renewable Sources
- Gauzin-Müller D., Sustainable Architecture and Urbanism. Concepts, Technologies, Examples, Basel, Berlin, Boston 2002

- Johansson T.B., Kelly H., Reddy A.KN., Williams R.H., Renewable s fuels and electricity for a growing world economy. Defining and Achieving the Potential. Washington D.C. 2009
- Schittich Ch., Thoughts in Ecological Building , Architecture and Urbanism 5/1997
- Steiger P., Plenar – Domus, Baumeister 10/ 1996
- Williams D**.** E. FAIA Sustainable design: ecology, architecture and planning , Hoboken, New Jersey 2007

Course type: Field lectures and seminars

Assessment method: Final test and presentation

Primary target group: students of Master degree

Lecturer: Elżbieta Węcławowicz-Bilska Prof. PhD DSc Arch., Magdalena Marx-Kozakiewicz PhD, Arch.

Contact person: Elżbieta Węcławowicz-Bilska, Prof. PhD DSc Arch.
phone #: +48 12 628 24 66,
e-mail: eweclaw@poczta.onet.pl

Deadline for application: beginning of the Fall Semester (according to the schedule)

COURSE TITLE: **ECO –CITY CONCEPT**

Institute/Division: A5 Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Number of contact hours: 60

Course duration: 1 semester (Spring)

ECTS credit: 7

Course description: Preparation of urban development projects taking into consideration actual and future concepts of eco-city becomes the need in the process of teaching architecture and urban design & planning.
The concept of eco-city design project deals with the creation of a new layout of ecological town in the surroundings of Cracow or of the transformation of definite fragment of the city as an estate or district .
Applying of urban and latest technical solutions in the range of sustainable development of urbanized areas including: development of degraded of neglected terrains (biological active and build up), energy supply from renewable sources, as well as limiting environmental various pollution is going to be the basis of spatial concepts.

Literature: Basic literature on the subject of urban design and ecology

Course type: Individual or team work (groups of 2-3 students) under supervision and tutorial (continuation of Environmental Protection and Ecology seminar, but open for students not attending the previous course)

Assessment method: Concept of ecological urban design project plus description of proposed idea and specific solutions with perspective sketches

Primary target group: 5th year students in Architecture

Lecturer: Prof. Elżbieta Węcławowicz-Bilska, PhD DSc Arch., Magdalena Marx-Kozakiewicz PhD Arch.

Contact person: Prof. Elżbieta Węcławowicz-Bilska, PhD DSc Arch.
phone #: +48 12 628 24 66,
e-mail: eweclaw@poczta.onet.pl

Deadline for application: beginning of the Spring Semester (according to the schedule)

ARTISTIC SUBJECTS

COURSE TITLE: **PHOTOGRAPHY**

Institute/Division: A1 - Institute of History of Architecture and Monument Preservation

Course code: A-2

Erasmus subject code: 02.9, 03.0

Number of contact hours: 30

Course duration: 1 semester (available in Fall and Spring semesters)

ECTS credits: 2

Course description: Practical introduction to photography as well as to digital image processing techniques. Practical application of photography in architectural work. Developing skills in using archive photography as an iconographic element.

Literature: William J. Mitchell: *The Reconfigured Eye. The digital truth in the post-photographic era*

Course type: Individual photographic work under supervision and tutorial

Assessment method: Attendance and evaluation of submitted work

Primary target group: All level students of the Architecture and Landscape Architecture

Lecturer: Zbigniew Wikłacz, PhD Arch.

Contact person: Zbigniew Wikłacz, PhD Arch., phone #: +48 12 628-24-16
e-mail: wiklacz@pk.edu.pl, wiklacz@gmail.com

Deadline for application: beginning of the Fall or Spring Semester (according to the schedule)

COURSE TITLE: **FREEHAND DRAWING AND PAINTING**

Institute/Division: A7 Independent Division of Freehand Drawing, Painting and Sculpture

Number of contact hours: 30

Course duration: 1 semester (Fall)

ECTS credits: 2

Course description: Painting and composition. Studies in painting based on a still life, from a simple composition of a limited range of colours to more elaborate compositions that require free interpretation – under condition of retaining of compositional values. Design of a painting composition, architectural painting for a chosen building, colour scheme for an elevation. Contexts, painting, architecture. Techniques: tempera, acryl, water colour and collage. To develop sensitivity to beauty, colour and light, skill of building compositions based upon observation and imagination. Integration of arts – phenomena in architectural space and their solutions. To develop skills of searching for a concept (sketches in chosen techniques) – colour scheme for an elevation, with application of computer techniques.

Literature:

- Maria Rzepińska „Historia koloru"
- Michał Mrugalski „Teoria barw Różewicza"
- Gerhard Zeugner „Barwa i człowiek"

Course type: Individual drawings in different techniques under supervision and tutorial

Assessment method: A set of all works should be completed and presented

Prerequisites: Basics of freehand drawing and composition

Primary target group: All levels students in Architecture and Landscape Architecture

Lecturer: Iwona Zuziak, Assoc. Prof. DSc PhD Arch.

Contact person: Maria J. Żychowska, Prof. DSc PhD Arch.
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **FREEHAND DRAWING - ARCHITECTURAL PERPECTIVE DRAWINGS**

Institute/Division: A7 Independent Division of Freehand Drawing, Painting and Sculpture

Number of contact hours: 30

Course duration: 1 semester (Fall)

ECTS credits: 2

Course description: Using the image in perspective to presentation of architectural historical and contemporary phenomena and own designs. All work in one technique: ink. Generally, the goal is the formation of artistic imagination through freehand drawing. Particularly: forming sketching skills , using quick, synthetic drawings to note different problems in order to unlimited expressing and illustrating demanded tasks and own ideas, also developing skills of presenting spatial creations and shaping space.

Literature:

- *7 bram do Krakowa. Znak jako początek przestrzeni,* praca zb., Kraków 2001.
- Alberti L. B., *Ksiąg dziesięć o sztuce budowania,* Warszawa 1960
- Bartel K., *Perspektywa Malarska*, Warszawa 1958
- Białkiewicz A., *Rola rysunku w warsztacie architekta. Szkoła krakowska w kontekście dokonań wybranych uczelni europejskich i polskich,* Kraków 2004.
- Bruzda J., *Szkice perspektywiczne,* Kraków 1998,
- Gajewski P., *Zapisy myśli o przestrzeni,* Kraków 2001.
- Lupton E., *Design Writing Research: Deconstruction*, www.elupton.com
- Misiągiewicz M., *Między ideą a rzeczywistością. Rysowane obrazy architektury, [w:] Prace polskich architektów na tle kierunków twórczych w architekturze i urbanistyce w latach 1945-1995*, t. IV, WA PK Kraków 1994.
- Misiągiewicz M., *O prezentacji idei architektonicznej*, Kraków 2003.
- Monestiroli A., *Osiem definicji architektury [w:] Definiowanie Przestrzeni Architektonicznej. Architektura jako sztuka,* Kraków 2004, s.105-115

Course type: Individual drawings in different techniques under supervision and tutorial

Assessment method: A set of all works should be completed and presented

Prerequisites: Basics of freehand drawing and composition

Primary target group: All levels students in Architecture and Landscape Architecture

Lecturer: Maria J. Żychowska, Prof. DSc PhD Arch.,

Contact person: Maria J. Żychowska, Prof. DSc PhD, Arch.
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **FREEHAND DRAWING AND PAINTING - STILL LIFE STUDIES**

Institute/Division: A7 Independent Division of Freehand Drawing, Painting and Sculpture

Erasmus subject code: 02.9

Number of contact hours: 48

Course duration: 1 semester (Spring Semester)

ECTS credits: 3

Course description: The task of the course is forming observational skills (including a sense of proportion, forms, the effects of light in space, sensitivity to beauty), improving artistic expression, rapid formal synthesis and recording spatial images through sketching.

Drawing tasks:

- studio: still-life, furniture arrangements, interior simulations, architectural details, stain-glass, classical sculpture, masses;
- outdoor: monuments and contemporary architectural objects.

Literature:

- Maria J. Żychowska: *Współczesne witraże polskie;*
- Jan Bruzda: *Szkice perspektywiczne w architekturze;*
- Research work carried by Andrzej Białkiewicz

Course type: Individual drawing and painting under supervision and tutorial

Assessment method: Evaluation of all assigned works (progress, personal creativity & individual approach)

Primary target group: All level students in Architecture and Landscape Architecture

Lecturer: Maria J. Żychowska, Prof. DSc PhD Arch.
Andrzej Białkiewicz, Assoc. Prof. DSc PhD Arch.

Contact person: Maria J. Żychowska, Prof., DSc, PhD, Arch.,
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **FREEHAND DRAWING – PAINTING AND COMPOSITION**

Institute/Division: A7 Independent Division of Freehand Drawing, Painting and Sculpture

Course code: B5-1

Erasmus subject code: 02.9

Number of contact hours: 30

Course duration: 1 semester (Spring Semester)

ECTS credits: 2

Course description: The task of the course is to develop additional experience and skills in constructing problems from the viewpoint of the variety of ways of studying and creating reality. The course contains painting and graphic exercises regarding the development of: spatial imagination; skills in using diagrams and artistic symbols; awareness of the variety of artistic means for expressing different concepts.

Course type: Individual drawings in different techniques under supervision and tutorial

Assessment method: Evaluation of all assigned works (progress, personal creativity & individual approach)

Prerequisites: Basics of freehand drawing and composition

Primary target group: All levels students in Architecture and Landscape Architecture

Lecturer: Ewa Gołogórska-Kucia, Prof. of Art

Contact person: Maria J. Żychowska, Prof. DSc PhD Arch.
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **FREEHAND DRAWING AND COMPOSITION**

Institute/Division: A7 Independent Division of Freehand Drawing, Painting and Sculpture

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: Practical exercise during so called laboratories and student's own homework; individual corrections. Works in various painting and graphic techniques. Developing of composition skills, spatial imagination and enhancing skills in solving of design tasks in various conventions related to fine arts.
Education in fine arts and artistic techniques. Studies in observation of reality and enhancing of skill of choosing of adequate and coherent mode of notation and depiction of a given problem.

Literature:

- *Kubiści,* Guilaume Apollinaire, WL, Kraków 1959
- *Słownik kierunków, ruchów i kluczowych pojęć sztuki drugiej połowy XX wieku,* Marcin Giżycki, słowo\ obraz\ terytoria, Gdańsk 2002
- *Nowoczesność od czasu postmodernizmu,* Dick Higgins, słowo\ obraz\ terytoria, Gdańsk 2000
- *O sztuce nowej i najnowszej*, Piotr Krakowski, PWN, 1981
- *Futuryzm,* Giovanni Lista, Arkady, Warszawa 2002
- *Ikonosfera*, Mieczysław Porębski, PIW, Warszawa 1972
- Kubizm, , Mieczysław Porębski, wprowadzenie do sztuki XX wieku, PWN, Warszawa 1968
- *O pochodzeniu formy w sztuce*, Herbert Read, PIW, 1973
- *Teoria widzenia,* Władysław Strzemiński, WL, Kraków 1969
- *Wybór pism estetycznych,* Władysław Strzemiński, Universitas, Kraków 2006
- *Martwa natura*, Charles Sterling, WA i F i PWN, Warszawa 1998
- *Awangardowe marginesy,* Andrzej Turowski, Instytut Kultury, Warszawa 1998 *Budowniczowie świata,* Andrzej Turowski, Universitas, Kraków 2000

Course type: Individual drawings in different techniques under supervision and tutorial

Assessment method: Submission of a complete set of works ; final mark is the average of all marks.

Prerequisites: Basics of freehand drawing and composition

Primary target group: All levels students in Architecture and Landscape Architecture

Lecturer: Ewa Gołogórska-Kucia, Prof. of Art

Contact person: Maria J. Żychowska, Prof. DSc PhD Arch.
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **SCULPTURE**

Institute/Division: A-7 Independent Division of Freehand Drawing, Painting and Sculpture

Course code: B5-2

Erasmus subject code: 03.1

Number of contact hours: 15

Course duration: 1 semester (Fall and Spring)

ECTS credits: 1

Course description: The course goal is to acquaint students with the principles of creating spatial compositions and the development of imagination and manual abilities. Lectures – sculpture in architecture: location, spatial composition, information about materials and artistic techniques in architecture. Tutorials – forming spatial compositions: idea, proportions, contrast, direction, dynamics, relationship with the surrounding and light.

Course type: Individual sculpture work under supervision and tutorial

Assessment method: Evaluation of 6 spatial compositions (progress, personal creativity & individual approach)

Primary target group: All levels students in Architecture and Landscape Architecture

Lecturer: Stefan Dousa, Prof. of Art

Contact person: Maria J. Żychowska, Prof., DSc, PhD, Arch.,
phone #: +48 12 628 24 38 or +48 12 637 24 36;
e-mail: pazychow@cyf-kr.edu.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

PROJECTS/ DESIGNING

ARCHITECTURAL & URBAN DESIGN

COURSE TITLE: **RESIDENTIAL BUILDINGS I (SINGLE-FAMILY HOUSING)**

Institute/Division: Institute of Architectural Design, Chair of Housing

Course code: C3-2-2

Erasmus subject code: 02-1

Number of contact hours: 150 per semester

Course duration: 1 semester (available in Fall and Spring semesters)

ECTS credits: 8

Course description: A two-semester course in architectural and urban design addressing the issues of: *The House or Play with the Cube* (in the Fall semester), *Architecture of the minimum – The House in the Landscape – Concrete Architecture* (in the Spring semester).
The project of single family dwellings and small residential complexes in a theoretical setting includes:

- the choice of a design idea and its basis; the design on the basis of a modular grid;
- relations between various residential spaces, a composition of architectural forms;
- a composition of the architectural setting: small architecture, greenery, design of private and public spaces;
- techniques of the project's presentation;
- working with architectural models and visualizations;
- an essay on the theoretical basis of the concept with a technical description of the project.

Literature: Basic literature on the architectural composition and design; architectural magazines.

Course type: Individual design work under supervision and tutorial.

Assessment method: Submission of the project on time; Positive evaluation of mid-term and final design reviews; Systematic work during the semester; Submission of the essay on a subject related to the design task.

Prerequisites: Architectural and Urban Design Studio

Primary target group: 2nd year students in Architecture

Lecturer: Dariusz Kozłowski, Prof. DSc PhD Arch.

Contact person: Ernestyna Szpakowska, PhD, Arch.,
phone #: +48 12 628-20-21
e-mail: ernestynaszpakowska@gmail.com

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

Remarks: The design tasks are different in each semester

COURSE TITLE: **RESIDENTIAL BUILDINGS II (MULTI-FAMILY HOUSING)**

Institute/Division: A2 Institute of Architectural Design, Chair of Housing

Course code: C3-3-2

Erasmus subject code: 02-1

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: The task is to design a multifamily residential building located at the given site, as an element of a model residential complex. The provided site plan presents legally binding regulation lines, delimiting the scale of the residential building, beyond the zone of the historic architecture's influence. The exercise includes the project of the building's form and its surroundings, apartments (3 types of flats), an entrance hall, adjacent rooms and parking facilities.
Within the scope of design's presentation fall: a site plan 1:500, plans of all floors 1:100, chosen vertical sections 1:100; elevations 1:100; a vertical section through an external wall 1:20, a handmade perspective drawing, an axonometric drawing and a brief description of the idea with a technical description.

Literature: Literature on architectural composition and the design of housing architecture; architectural magazines

Course type: Individual design work under supervision and tutorial

Assessment method:

- Submission of the project on time;
- Positive evaluation of mid-term and final design reviews;
- Systematic work during the semester;
- Submission of the essay on a subject related to the design task.

Prerequisites: Architectural and Urban Design Studio

Primary target group: 3rd year students in Architecture

Lecturer: Dariusz Kozłowski, Prof. DSc PhD Arch.

Contact person: Ernestyna Szpakowska, PhD Arch.,
phone #: +48 12 628-20-21
e-mail: ernestynaszpakowska@gmail.com

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II (MULTI-FAMILY HOUSING)**
ARCHITECTURAL AND URBAN DESIGN OF RESIDENTIAL COMPLEXES A

Institute/Division: A2 Institute of Architectural Design, Division of Architectural Composition

Course code: C3-3-2

Erasmus subject code: 02-1

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: Course in architectural and urban design of a defined urban residential block: choice and fundamentals of an idea; search for pretexts of an urban form; theory of an ideal city – work with modules and urban grids; relations between residential spaces: urban block, street, squares, private spaces, public spaces, circulation, functional solutions, site development concept, residential building concept, functional programme, structural solutions, presentation techniques, work with renderings and visualisations, preparation of an essay linked to the design task.

Literature: Literature on architectural composition and the design of housing architecture; architectural magazines

Course type: Individual design work under supervision and tutorial

Assessment method:

- Submission of the project on time;
- Positive evaluation of mid-term design reviews
- Positive evaluation of drawing tests
- Systematic work during the semester
- Submission of the essay on a subject related to the design task

Prerequisites: Architectural and Urban Design Studio

Primary target group: 3rd year students in Architecture

Lecturer: Maria Misiągiewicz, Prof., DSc, PhD Arch.

Contact person: Mariusz Twardowski, PhD Arch., phone #: +48 12 628-20-21
e-mail: mt@twardowskiwokan.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II (MULTI-FAMILY HOUSING)**
ARCHITECTURAL AND URBAN DESIGN OF MULTIFAMILY HOUSING A

Institute/Division: A3 Institute of Urban Design, Division of Urban Composition

Course code: C3-3-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: The course programme includes selected architectural and urban issues related to the shaping of intensive forms of habitat in a city. The subject is a concept of a building or a complex of several buildings of a residential function together the necessary services resulting from the site conditions and a concept of land development. The development which complements the existing urban tissue, is related to a defined urban spatial, functional and cultural context. A design may also concern the problems of the revitalization of some degraded areas and conversion of some post-industrial objects (lofts) to residential functions. A design includes the development of a building lot of c. 1 ha and an urban public space related to the location: hardened pedestrian and vehicular surfaces, car parks, biologically active areas – greenery, small architecture, lighting, drainage.
The basis for the definition of the programme for this investment and the definition of its spatial and functional relations with the nearest surroundings is an analysis of the location conditions – the urban analysis. The students

can choose one of two locations in an urban context offered in the course. The design includes the preparation of a plan of implementation, an architectural concept of a chosen building and details (technical and material solutions).

Literature: Basic literature on urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Jacek Gyurkovich, Prof. DSc PhD Arch.

Tutors: Mateusz Gyurkovich PhD Arch., Wojciech Wicher, PhD Arch., Agnieszka Wójcik, PhD Arch.

Contact person: Agnieszka Wójcik, PhD Arch.; phone #: +48 12 628 24 28
e-mail: aga_vv@op.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II – ARCHITECTURAL AND URBAN DESIGN OF MULTIFAMILY HOUSING B**

Institute/Division: A3 Institute of Urban Design, Division of Urban Composition

Course code: C3-3-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: It is about important architectural and urban issues related to the form of intensive housing environment in an urban context.
It is a project of a small size multi-family complex in an urban context. Student having regard to the modern methods and trends at shaping a multi-family residential environment prepares the idea concept in the context of specific conditions and formulate a program of a complex.
The project includes:

- urban analysis leading to establish guidelines for the concept of a whole complex regarding external relations and to find the right formula for both function and form for the proposed complex,
- the concept in a scale 1:500 to outline the concept of open space /public to private/ and relationships between volumes and open spaces,
- plans, sections and elevations of the proposed buildings, or its fragments in a scale 1:100
- details (technical and material solutions). in a scale 1:20,
- schemes, sketches, visualizations and hand drawing showing the concept,
- thematic essay and a description of the project.

Literature: Basic literature on urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision of a tutor

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,

Contact person: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch., phone #: +48 12 628 24 30;
e-mail: akanta@poczta.onet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II (MULTI-FAMILY HOUSING)**
RESIDENTIAL INFILL IN THE URBAN FABRIC

Institute/Division: A3 Institute of Urban Design, Chair of Urban Renewal and Development

Course code: C3-3-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: The course teaches the method of architectural and urban design of multi-family residential building (or buildings) in the context of a site in the urban fabric including their functional and spatial relations.
The course aims at:

- Presenting the fundamental problems of housing design;
- Developing the ability to solve more complex design problems by applying the method of analysis and synthesis;
- Further development of professional vocabulary comprising expressions, principles and ideas;
- Improving the ability to make use of professional literature, broadening the previously acquired knowledge and skills through developing the ability observe, perceive, create and express the architectural message.

Literature: Basic literature on urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision and tutorial

Assessment method: Participation in the course and design – reviews; evaluation of the completed project, jury; class involvement, general attitude.
Scope of the project: architectural project with the urban context 1:100 (plans, cross-sections, elevations), construction detail 1:20, model 1:100, project description (3000 words), freehand drawing- perspective of the building in the urban context.

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc, PhD, Arch..;

Tutors: Małgorzata Mizia, PhD Arch , Krzysztof Kwiatkowski PhD Arch.

Contact person: Małgorzata Mizia, PhD, Arch.; phone #: +48 12 628 24 34; e-mail: mmizia@o2.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II (MULTI-FAMILY HOUSING)**
ARCHITECTURAL AND URBAN DESIGN OF RESIDENTIAL COMPLEXES B

Institute/Division: A3 Institute of Urban Design, Chair of Urban Renewal and Development

Course code: C3-3-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: The design task is the urban and architectural design concept of a multi-family residential complex of an infill type in the urban context – along with the service buildings and the development o the surroundings.
The design method is based upon studies of composition functional and spatial relations of the context: analysis of the existing fabric, transportation and circulation systems as well as the context of nature. Pro-ecological solutions are preferred (energy-saving and sustainable design).
To master the design skills in the above field, thus respecting:

- the principles of the legible composition in the context of the existing urban fabric, public space, individual site conditions, climate (built and natural environment) and tradition of the site
- proper choice of the programme, structure of residential architecture, principles of scale, internal and external connections, aesthetics and further criteria of evaluation (sustainability)

To develop the skills of presentation of own design
To develop the skills of using the literature as well as comparative and case studies.

Literature: Basic literature on urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision and tutorial

Assessment method: evaluation of the student's creative activity, design reviews, jury, completed exercises and projects.

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc PhD Arch.

Contact person: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc PhD Arch.
phone #: +48 12 628 24 34; email: wehle@tlen.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **RESIDENTIAL BUILDING DESIGN II (MULTI-FAMILY HOUSING)**
URBAN INFILL

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: C3-3-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: Individual design work accompanied by introductory lectures, common discussions and students presentations of subsequent stages of concept development. The design task is to solve mixed-use building in central location, complementing the existing street façade. The formulation of the architectural concept is preceded by the detail analysis of urban context helping to determine the proper functional and spatial relation between urban infill and neighboring buildings and to create comfortable and friendly public spaces making the social contacts easier.
The course goal is to broaden students' knowledge on:

- functional, spatial and usable surface standards of the apartments that are fulfilling diversified needs of a contemporary society;
- standards related to the equipment of residential buildings and accompanied functions/structures;
- designing of open spaces adjacent to urban infill – their zoning and social roles;
- varied ways of establishing the dialogue between the existing structures and newly built objects, technologically advanced
- contemporary trends related to sustainable design in the scale of an individual building

Literature: Basic literature on urban rehabilitation and design of residential complexes- to be given at the beginning of the course.

Course type: Design studio

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and urban Design Studio (e.g. Urban Composition, Single Family Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Anna Palej, Assoc. Prof. DSc PhD Arch.

Contact person: Anna Palej, Assoc. Prof., DSc PhD Arch.,
phone #: +48 12 628-31-13;
e-mail: annapalej@gmail.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SERVICE COMPLEXES DESIGN**

Institute/Division: A2 Institute of Architectural Design, Division of Public Use Buildings

Course code: C3-4-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Fall or Spring)

ECTS credits: 8

Course description: Project is divided into three subjects. A student elaborates three concept sketch designs re. Service buildings and complexes. Three theoretical variations of a site are a basis for the exercise – on the same spatial layout, however differing in level of urban development (from a freestanding building to an urban infill). Sketch projects in scale 1:200 are elaborated in two first cases (whereby in the first one hand sketches are obligatory; in the second the technique can be chosen). The third stage is based exclusively on studies on a model.

Literature:

- Rob Krier, *Stadtraum*
- Camillo Sitte, *City Planning*
- Le Corbusier, *Vers une Architecture*
- Żórawski Juliusz*, O budowie formy architektonicznej*

Course type: Individual design work under supervision and tutorial

Assessment method: The mark is an average of design marks and assessment of their juries.

Prerequisites: Architectural and Urban Design Studio

Primary target group: 3rd year students in Architecture

Lecturer: Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch..

Contact person: Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch.
phone #: +48 12 628-24-42; email: one@piotrgajewski.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE: **PUBLIC USE BUILDING DESIGN I (advanced design)**

Institute/Division: A2 Institute of Architectural Design, Division of Public Use Buildings

Course code: C3-6-2

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (available in Fall and Spring semesters)

ECTS credits: 7

Course description: The task of the course is mastering the skills of designing complex public use building(s). The detailed design of the object in architectural scales (1: 500, 1: 200, 1: 100, 1: 20) is proceeded by the analysis of a spatial-functional connection with further urban context. An important part of

	the final submission is 3D re-presentation (study and final models, computer visualization)
Literature:	Basic literature on urban composition and the design of public use buildings; architectural magazines
Course type:	Individual design work under supervision and tutorial
Assessment method:	Evaluation of the final submission (process, progress, personal creativity & individual approach, text and graphic presentation)
Prerequisites:	Architectural and Urban Design Studio
Primary target group:	4th and 5th year students in Architecture
Lecturer:	Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch.
Contact person:	Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch. phone #: +48 12 628-24-42; email: one@piotrgajewski.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE:	**PUBLIC USE BUILDING DESIGN II (Master degree - advanced design)**
Institute/Division:	A2 Institute of Architectural Design, Division of Public Use Buildings
Course code:	II-C-7
Erasmus subject code:	02.1 / 02.3
Number of contact hours:	105
Course duration:	1 semester (Fall semester)
ECTS credits:	8

Course description: The task of the course is mastering the skills of designing complex public use building(s). The detailed design of the object in architectural scales (1: 500, 1: 200, 1: 100, 1: 20) is proceeded by the analysis of a spatial-functional connection with further urban context. An important part of the final submission is 3D re-presentation (study and final models, computer visualization)

Literature: Basic literature on urban composition and the design of public use buildings; architectural magazines

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, text and graphic presentation)

Prerequisites: Architectural and Urban Design Studio

Primary target group: 5th year students in Architecture

Lecturer: Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch.

Contact person: Piotr Burak-Gajewski, Assoc. Prof. DSc PhD Arch.
phone #: +48 12 628-24-42; email: one@piotrgajewski.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **ARCHITECTURAL DESIGN OF SERVICE BUILDINGS – NATURALLY SHAPED ARCHITECTURE (NSA 1&2)**

Institute/Division: A2 Institute of Architectural Design, Chair of Environmental Architecture

Course code: I-C-20

Erasmus subject code: 02.1

Number of contact hours: 90

Course duration: 1 semester (Fall and/or Spring semester)

ECTS credits: 8

Course description: The aim of the course is to acquire competence in: (1) analysis of a simple real situation (multidimensional, physical, social, and cultural environment); (2) preparing architectural design project of minor complexity (e.g.: small stand, pedestrian bridge, sports hall, swimming pool, tourist hotel, and the like); (3) adapting structural solution to the designed space (obligatory work model). Naturally Shaped Architecture (NSA) means inclusive architectural design focused on the user, the user's needs, functional solution, structure organically serving the designed space, the whole fitting the environment. The course embraces site visit, visit(s) of new building sites, 2 design tasks pro semester (1 – introductory, 2 – main), 2-3 reviews pro semester, 3 invigilated sketch design exercises (*klauzura*), study and work models, final presentation. Students are urged to apply the pattern language technique in their design.

Literature:

- Alexander, Christopher *et al*., *A Pattern Language*
- Gehl Jan, *Life Between Buildings*
- Lynch, Kevin, *The Image of the City*
- Neufert, Ernst, *Neufert Architects' Data*
- Pallasmaa Juhani, *The Eyes of the Skin: Architecture and the Senses*
- Rassmussen Steen Eiler, *Experiencing Architecture*
- Siegel Curt, *Structure and form in modern architecture*
- Zumthor Peter, *Thinking Architecture*
- Żórawski Juliusz*, O budowie formy architektonicznej* (in Polish)

Course type: Individual design work under supervision and tutorial + seminars

Assessment method: Evaluation of the final submission (design process, personal creativity & individual approach, presentation quality)

Prerequisites: Architectural and Urban Design Studio

Primary target group: 3rd year students in Architecture

Tutors: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch.;
Angelika Lasiewicz-Sych, Ph.D., Arch.;
Piotr Winskowski, Ph.D., Arch.

Contact person: Prof. J. Krzysztof Lenartowicz, Ph.D. D.Sc. Arch.
Phone #: (+48) 12 628 26 62

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE: **ARCHITECTURE DESIGN OF PUBLIC USE BUILDINGS – NATURALLY SHAPED ARCHITECTURE (NSA 3) – advanced design**

Institute/Division: Institute of Architectural Design, Chair of Environmental Architecture

Course code: I-C-20

Erasmus subject code: 02.1

Number of contact hours: 90

Course duration: 1 semester (available in Fall semester)

ECTS credits: 7

Course description: The aim of the course is to acquire competence in: (1) analysis of a complex real situation (multidimensional, physical, social, and cultural environment); (2) preparing architectural design project of medium complexity (e.g.: public library, lonely mother's home, hospital ward, large sports hall, ice rink, aqua park, sport complex, and the like); (3) adapting structural solution to the designed space (obligatory work model). Naturally Shaped Architecture (NSA) means inclusive architectural design focused on the user, the user's needs, functional solution, structure organically serving the designed space, the whole fitting the environment. The course embraces site visit, visit(s) of new building sites, 2 design tasks pro semester (1 – introductory, 2 – main), 2-3 reviews pro semester, 3 invigilated sketch design exercises (klauzura), work model, final presentation.

Literature:

- Alexander, Christopher et al., A Pattern Language
- Gehl Jan, Life Between Buildings
- Neufert, Ernst, Neufert Architects' Data
- Pallasmaa, Juhani , The Eyes of the Skin: Architecture and the Senses
- Rassmussen, Steen Eiler, Experiencing Architecture
- Żórawski, Juliusz, O budowie formy architektonicznej
- Zumthor, Peter, Thinking Architecture

Course type: Individual design work under supervision and tutorial + seminars

Assessment method: Evaluation of the final submission (design process, personal creativity & individual approach, presentation quality)

Prerequisites: Architectural and Urban Design Studio

Primary target group: 4th year students in Architecture

Tutors: Krzysztof Lenartowicz, Prof. J., Ph.D., D.Sc., Arch.; Angelika Lasiewicz-Sych, Ph.D., Arch.; Piotr Winskowski, Ph.D., Arch.

Contact person: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch. Phone #: (+48) 12 628 26 62

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **ARCHITECTURE DESIGN OF PUBLIC USE BUILDINGS – NATURALLY SHAPED ARCHITECTURE (NSA 4) – Master Degree Advanced design**

Institute/Division: Institute of Architectural Design, Chair of Environmental Architecture

Course code: II-C-7

Erasmus subject code: 02-1

Number of contact hours: 105

Course duration: 1 semester (Fall)

ECTS credits: 8

Course description: The aim of the course is to develop skills in less practiced fields of architectural design and planning. Specifically oriented information is delivered: social dialogue in architectural design and planning (theory and techniques, workshops); practice of social participation in design decision making process; revitalization of post-industrial, post-railway, and post-military areas and facilities. Naturally Shaped Architecture (NSA) means inclusive architectural design focused on the user, the user's needs, functional solution, structure organically serving the designed space, the whole fitting the environment. The course embraces site visit, visit(s) of new building sites, design task, 2-3 reviews, invigilated sketch design exercises (klauzura), work model, final presentation.

Literature: Literature on social participation in architectural design and planning; and on revitalization of towns

- Blundell-Jones Peter; Petrescu D., and Till, Jeremy (eds.) Architecture and Participation
- Jones, Bryn, Participation – Management Tool or Political Foundation? Local civil society organization's involvement in regeneration schemes in England and Italy [in:] Kleczkowski P. (ed.) Metody zarządzania odnową miast
- Lenartowicz, J-K, Zarządzanie a społeczność lokalna – konflikt, współpraca, czy przejęcie władzy? [in:] Kleczkowski P. (ed.), Metody zarządzania odnową miast [in Polish]
- Lenartowicz J-K., Maciąg, Diana, Od terenów przemysłowych do… / From industrial areas to …
- Nyka, Lucyna, Szczepański, Jakub, Culture for Revitalisation / Revitalisation for Culture
- Poda, Ryszard, SOLVAY yesterday and today
- Tagliaferri, Mariarosaria (idea), Industrial Chic. Reconverting Spaces
- URBACT: Culture and urban regeneration. Culture activities and creative industries

Course type: Individual design work under supervision and tutorial

Assessment method: Submission of design project and essay

Prerequisites: Architectural and Urban Design Studio

Target group: 5th year students in Architecture (MA course, Fall semester)

Tutors: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch.;
Angelika Lasiewicz-Sych, Ph.D., Arch.;
Piotr Winskowski, Ph.D., Arch.

Contact person: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch.
Phone #: (+48) 12 628 26 62

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **ARCHITECTURE DESIGN OF PUBLIC USE BUILDINGS – NATURALLY SHAPED ARCHITECTURE (NSA 5) – DIPLOMA PROJECT**

Institute/Division: Institute of Architectural Design, Chair of Environmental Architecture

Course code: II-C-17

Erasmus subject code: 02-1

Number of contact hours: 15

Course duration: 1 semester (Spring)

ECTS credits: 20

Course description: The aim of the course is to develop skills in highly complex design tasks of student's own choice (guided by the teacher). Naturally Shaped Architecture (NSA) means inclusive architectural design focused on the user, the user's needs, functional solution, structure organically serving the designed space, the whole fitting the environment. Study tour organized on request.

Literature: Literature on the subject of architectural design

Course type: Individual design work under supervision and tutorial

Assessment method: Submission of design project and essay on architecture + description

Prerequisites: Architectural and Urban Design Studio

Target group: 5th year students in Architecture (MA diploma project)

Teachers: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch.;
Angelika Lasiewicz-Sych, Ph.D., Arch.;
Piotr Winskowski, Ph.D., Arch.

Contact person: J. Krzysztof Lenartowicz, Prof., Ph.D., D.Sc., Arch.
Phone #: (+48) 12 628 26 62

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **INDUSTRIAL ARCHITECTURAL DESIGN**

Institute/Division: A2 - Institute of Architectural Design, Division of Industrial Architecture Design

Course code: C3-5-2

Erasmus subject code: 02.1

Number of contact hours: 90

Course duration: 1 semester (Fall semester)

ECTS credits: 7

Course description: The task of the course is architectural solution of industrial functional complex (workplaces) or public use buildings (industrial plant, transportation facilities building or car service station, office building, exhibition pavilion or art gallery, etc). One of the selected design problems is always a frame of conditions of current student competition or official awarding contract for public order technical documentation. During the course students draw up a functional diagram, site plan concept, architectural solution including plans, sections, project of the elevations, handmade perspective drawings, computer visualizations.

Literature: Basic literature on architectural design

Course type: Individual design work under supervision and tutorial + seminars

Assessment method: Evaluation of the design exercises (3 exercises per semester) and final submission (process, progress, personal creativity & individual approach, text and graphic presentation)

Prerequisites: Architectural and Urban Design Studio

Primary target group: 4th year students in Architecture

Lecturer: Maciej Złowodzki, Prof., DSc, PhD Arch.

Tutor: Krzysztof Ludwin, PhD Arch.

Contact person: Krzysztof Ludwin, PhD, Arch.,
phone #: +48 12 628-24-48;+48 513 158 199;
email: ludwin@ludwin.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPATIAL PLANNING A**

Institute/Division: Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Course code: II-C-11

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 7

Course description: Design work concerns development of the city spatial plan on a given land-surveying plan, with information worked out and gathered during vacation inventory practice in the chosen town or city.
On the base of land use inventory, city's space quality evaluation and other information students work on:

- synthesis of conditions of city development,
- diagnose stressing natural, environmental, cultural and social conflicts,
- the basis of variations of directions and possibilities of the future city development, following the evaluation of variations and choosing optimal solutions students work on:
- city local spatial plan design – the basic drawing, including explanation of:
- principles of crystallization of city grid – composition scheme,
- principles of the city traffic and transport solutions and urban, infrastructure elements scheme,
- principles of plan achievement - scheme
- general description, text regarding problems solving, needs and local communities' aspirations.

Literature: Basic literature on physical planning

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation)

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighbourhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Prof. Elżbieta Węcławowicz-Bilska DSc PhD Arch.

Tutor: Rafał Blazy PhD Arch.

Contact person: Elżbieta Węcławowicz-Bilska, Prof. DSc PhD Arch.
Phone #: +48 12 628-24-66;
e-mail; eweclaw@poczta.onet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPATIAL PLANNING B**

Institute/Division: Institute of City and Regional Design; Division of Physical Planning and Environmental Protection

Course code: II-C-11

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 120

Course duration: 1 semester (Fall)

ECTS credits: 7

Course description: Crucial tasks of the projects are:

- Defining characteristic features of spatial and functional structure of small town including its structural relations with regional context and defining basic elements of developmental conditions of this town.
- Interpreting (in synthetic form) main features of the student's concept for the development of selected town focusing on spatial elements of its structure.
- Defining basic elements of spatial layout of the future development designed on selected fragment of urban area and presenting this concept in a way, which would convince a potential client that a project proposal is attractive enough to be implemented.
- Clear description (text) of developmental conditions of the town and convincing description in text proposed design solutions compatible with these conditions.

Literature: Basic literature on physical planning

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation) defend own project proposals in front of the class

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighbourhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Zbigniew Zuziak, Prof., DSc, PhD Arch.

Tutors: Bogdan Podhalański PhD Arch.,
Daniel Ogrodnik PhD Arch.

Contact person: Zbigniew Zuziak, Prof., DSc, PhD, Arch.,
e-mail: a5-institute@pk.edu.pl or zzuziak@nsnet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **DESIGN FOR CONSERVATION**

Institute/Division: Institute of History of Architecture and Monument Preservation, Chair of History of Polish Architecture and Monument Preservation

Course code: II-C-9

Erasmus subject code: 02.9

Number of contact hours: 105

Course duration: 1 semester (Fall or Spring)

ECTS credits: 7

Course description: The course task is mastering the skills of: gathering, preparing and using historical materials; designing within the historical fabric of the city; defining the limits of interference in the monument historical structure; adapting

and modernizing objects; practical application of preservation theories, techniques and technologies.
Final requirements: - historical surveys of buildings and sites; - architectural drawings: plans, sections, elevations in the scales; 1: 100 and 1: 50

Literature: Readings depend on the design task

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Preservation of Monuments & Revalorization (available in Fall Semester*)

Primary target group: 3rd, 4th, and 5th year students in Architecture

Lecturer: Andrzej Kadłuczka, Prof., DSc, PhD Arch.

Tutors: Anna Białasik, PhD Arch., Marta Urbańska, PhD Arch., Zbigniew Wikłacz, PhD Arch.

Contact person: Anna Białasik, PhD, Arch.,
phone #: +48 12 628-24-08; +48 600 312 236;
e-mail: bialasik@neostrada.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

Remarks: Students who study in Cracow only in Spring Semester may take Preservation of Monuments & Revalorization seminars (2 ECTS credits) accompanying the Design Studio (7 ECTS)

COURSE TITLE: **ARCHITECTURE AND PLANNING IN THE COUNTRYSIDE**

Institute/Division: A3 Institute of Urban Design, Division of Rural Architecture and Planning

Course code: I-C-23

Erasmus subject code: 02.0

Number of contact hours: 90

Course duration: 1 semester (available in Fall and Spring)

ECTS credits: 5

Course description: A growing interest in the countryside environment as a place to live as well as a place of escape from urban life challenges the architects. That is a reason we try to encourage students to seek new architectural and planning ideas for future development of the village as an alternative to urban living.
For the semester work a student may choose the planning project or the architectural project or both of them (the detailed subject and the particular scope of the project are always determined with the participation of the student).
The planning project is required as a concept of development of the chosen village in Poland or abroad.
The architectural project may be chosen from the following subjects: a countryside housing for farmer and non-farmer families; an ecological farm complex; a social-cultural centre for a small local community (an idea of “contemporary agora”); a hypo therapeutic centre for the handicapped.

Literature: Basic literature on countryside planning and architecture

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation)

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighbourhoods, Residential Buildings)

Primary target group: 3rd, 4th and 5th year students of Architecture

Lecturer: Marek Kowicki, Assoc. Prof., DSc, PhD, Arch.;
Tutor: English: Justyna Tarajko-Kowalska, PhD. Arch.,
German: Andrzej Zastawnik Msc Arch.

Contact person: Justyna Tarajko-Kowalska, PhD. Arch.,
phone #: +48 12 628-24-40, +48 503 671 682,
email: justarajko@tlen.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE: **REGIONAL PLANNING**

Institute/Division: Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Course code: II-C-12

Erasmus subject code:

Number of contact hours: 30

Course duration:

ECTS credits: 3

Course description: Subjects of lectures: basic notions and issues in regional planning, types of regions and their identification; objective and scope of regional planning, European integration issues, European regional cooperation in the scope of regional planning, new types of urbanization at regional scale: technopolises, basic issues in regional development in Poland, regional-scale designs and implementations of urban agglomerations, areas undergoing urbanization processes, recreational areas, and specially protected areas, in Poland and in the world; contribution of Polish architects and city planners to the development of European regional planning theory and practice; regional technical infrastructure hubs, systems and lines, motorways; water management

Large-group written and visual project/design concerning:

- selected studies at a regional scale plus diagnosing the current state of development in the region covered by the plan (individual work)
- initial concept for managing conflict or problem areas (group work).

As a rule, every student begins with the unassisted performance of the component task, and finishes with the group project.

Literature:

- M. Castels, P. Hall, Technopole of the Word
- Ch. Watson, Master Planning Science and Technology Park,
- Yi-Fu Tuan, Space and Place, the Perspective of Experience

Course type: Field lectures and team's projects

Assessment method: Final test and project presentation

Primary target group: 5th year Architecture students

Lecturer: Prof. Elżbieta Węcławowicz-Bilska, PhD DSc Arch. ,

Contact person: Prof. Elżbieta Węcławowicz-Bilska, PhD DSc Arch.
phone #: +48 12 628 24 66,
e-mail: eweclaw@poczta.onet.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE: **MULTI – FAMILY HOUSING DESIGN**

Institute/Division: A2 Institute of Architectural Design, Chair of Housing

Course code: II-C-7
Erasmus subject code: 02.1/02.3
Number of contact hours: 105
Course duration: 1 semester (Spring)
ECTS credits: 8

Course description: The design exercise under the motto *The ideal city – Architecture of the minimum – Contexts close and far*.
The task is to design a residential multifamily complex located at the given site in Cracow, as the complex of contemporary urban blocks. The exercise encompasses a composition of the complex, a design of the entire house and its surroundings, streets, driveways and pedestrian circulation, a solution of parking facilities and a verdure layout.
The scope of the design presentation encompasses: a site plan 1:500, plans of all floors 1:100, chosen vertical sections 1:100; elevations 1:100; a vertical section through an external wall 1:20; a handmade perspective drawing; an axonometric drawing and a description of an idea with a technical description.

Literature: Literature on architectural composition and the design of housing architecture; architectural magazines.

Course type: Individual design work under supervision and tutorial.

Assessment method:

- Submission of the project on time;
- Positive evaluation of mid-term and final design reviews;
- Systematic work during the semester;
- Submission of the essay on a subject related to the design task.

Prerequisites: Architectural and Urban Design Studio

Primary target group: 4th year students in Architecture

Lecturer: Dariusz Kozłowski, Prof. DSc, PhD Arch.

Contact person: Ernestyna Szpakowska, PhD, Arch.,
e-mail: ernestynaszpakowska@gmail.com, phone #: +48 12 628-20-21

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **MULTI-FAMILY HOUSING DESIGN – ARCHITECTURAL AND URBAN DESIGN OF MULTIFAMILY RESIDENTIAL COMPLEXES**

Institute/Division Institute of Urban Design, Division of Urban Composition

Course Code: II-C-7
Erasmus subject code: 02.1/02.3
Number of contact hours: 105
Course duration: 1 semester (Spring)
ECTS credits: 8

Course description: The course programme includes the architectural and urban issues related to the shaping of the contemporary housing environment in central areas. The subject of the course design is a spatial and programmatic urban conception of a complex of multifamily residential buildings in the spatial, functional and cultural context of the existing urban investments in developing or degraded areas under transformational processes and draft architectural conceptions of multifamily residential and service buildings which accompany housing, characteristic of the proposed structure, making it possible to confirm the realism of the accepted urban solutions .The basis for the formulation of a usable programme for the work and the definition of spatial and functional relations with the nearest surroundings is an urban analysis of the area and the nearest surroundings which make a zone of interactions. The students can choose one of two locations in an urban context offered in the course. It is also possible to prepare a design in an international, national or local students' competition. A design includes the preparation of an urban programme and spatial conception of a complex of multifamily residential buildings on an area of c. 10–15 ha. An urban conception needs suitable relations between an area, a city and the surroundings, including transport, functional and spatial connections, the formulation of a housing composition and the accompanying service buildings, the layout of vehicular, bicycle and pedestrian traffic, recreation and sports facilities, the composition of tall greenery.

Literature: Basic literature on the subject of urban composition and design of residential complexes

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Multifamily Housing)

Primary target group: 4th year students in Architecture

Lecturer: Jacek Gyurkovich, Prof., DSc, PhD Arch.;

Tutors: Mateusz Gyurkovich, PhD, Arch.,
Wojciech Wicher, PhD Arch.,
Agnieszka Wójcik, PhD Arch.;

Contact person: Agnieszka Wójcik, PhD Arch.;
phone #: +48 12 628 24 28;
e-mail: aga_vv@op.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **MULTI-FAMILY HOUSING DESIGN – ARCHITECTURAL AND URBAN DESIGN OF MULTIFAMILY RESIDENTIAL COMPLEXES**

Institute/Division Institute of Urban Design, Division of Urban Composition

Course Code: II-C-7

Erasmus subject code: 02.1/02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: It is about important architectural and urban issues related to the form of the contemporary housing environment in central areas.
It is a project of a multi-family housing estate in an urban context. Student having regard to the modern methods and trends at shaping a multi-family residential

environment prepares the idea concept in the context of specific conditions and formulate a program of an estate.
The idea of a contemporary housing environment is the main subject of a course.
The project includes:

- urban analysis leading to establish guidelines for the concept of a whole complex regarding external relations and to find the right formula for both function and form for the proposed complex,
- the concept in a scale 1:2000 as a regulatory plan to outline the concept of open space /public to private/ and relationships between volumes and open spaces /plan, visualizations from bird's eye and the human eye level /for chosen urban interiors as a base for urban orientation//,
- master plan in a scale 1:1000
- plans, sections and elevations of the proposed fragments in a scale 1:500
- schemes, sketches, visualizations and hand drawing showing the concept,
- thematic essay and a description of the project.

Literature: Basic literature on the subject of urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision of a tutor

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Multifamily Housing)

Primary target group: 4th year students in Architecture

Lecturer: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,

Contact person: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,
phone #: +48 12 628 24 30;
e-mail: akanta@poczta.onet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **MULTI-FAMILY HOUSING DESIGN – ARCHITECTURAL AND URBAN DESIGN OF RESIDENTIAL COMPLEX**

Institute/Division: A3 Institute of Urban Design; Division of Public Spaces for Movement

Course code: II-C-7

Erasmus subject code: 02.0

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Individual design work accompanied by introductory lectures, common discussions and students presentations of subsequent stages of concept development.
The design task is to solve residential complex creating comfortable, modern dwelling space with a human scale and compositional unity. The starting point to the formulation of architectural and urban concepts is the analysis of functional and compositional context as well as cultural and natural values of the existing environment
The course goal is to teach students:

- urban analysis and its role in the design implications' formulation;
- urban composition favoring peoples' identification with their place of habitation;

functional, spatial and surface area standards of the apartments fulfilling diversified needs of contemporary societies;

Literature: Basic literature on urban rehabilitation and design of residential complexes will be specified at the beginning of the course. Most of books will be available for students during class meetings.

Course type: Design studio

Assessment method: Evaluation of the final submissions (process, progress, personal creativity & individual approach, graphical and oral presentation)

Prerequisites: Architectural and urban design studio (e.g. Urban Composition, Single Family Housing, Urban Infill)

Primary target group: 3rd, 4th and 5th year students in Architecture

Lecturer: Anna Palej, Assoc.Prof. D.Sc. Ph.D. Arch.

Contact person: Anna Palej, Assoc.Prof. D.Sc. Ph.D. Arch., phone #: +48 12 628 31 13,
e-mail: annapalej@gmail.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN A**

Institute/Division: A3 Institute of Urban Design, Division of Urban Composition

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: The course is devoted to the problems of delimiting and shaping selected urban areas which – on account of their location in the spatial structure of cities – play or could play an important role as centers of service and public functions. Public spaces play a special role in city centers. Public spaces in a city – squares, streets, municipal parks and beaches, boulevards – are open-access places, remembered from the past and still attracting users with their peculiar climate, attractive for diverse meetings and contacts between city dwellers or newcomers. Places where the life of an urban community goes on. The places of public events, urban rituals. A public space and public buildings form an attractive offer of places for everyday life, a possibility of staying with other people, realizing social behaviors through partnership in urban shows of life. To a large extent, they owe the legibility of the spatial structure of a city to public spaces. The accompanying public buildings – dominants or strong forms – play an important role in the composition of an urban space and have a significant meaning in the shaping of the identity of places and the identification of diverse sequences of the urban tissue. The revitalization of former city centers or the transformation of areas degraded by industry or other users, absorbed as a result of the territorial expansion of cities, is one of the most urgent assignments in most European cities -in Poland as well.

Literature: Basic literature on the subject of urban composition and design of residential complexes

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Multifamily Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Jacek Gyurkovich, Prof., DSc, PhD Arch.;

Tutors: Mateusz Gyurkovich, PhD, Arch., Arch.,
Wojciech Wicher, PhD Arch.,
Agnieszka Wójcik, PhD Arch.;

Contact person: Agnieszka Wójcik, PhD Arch.; phone #: +48 12 628 24 28;
e-mail: aga_vv@op.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN B**

Institute/Division: Institute of Urban Design, Division of Urban Composition

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: The course is devoted to the problems of formulating a form and a functions of a selected urban areas which play or could play an important role as centres of service and public functions.

The main target is to propose a new urban spaces which are integrated in formal and functional context. A system of urban public spaces and attractive programme is crucial.

Final composition should be regarded as an integrated formal composition as well as a good perceptual system, based on rules of good special orientation.

The project includes:

- urban analysis leading to establish guidelines for the concept of a chosen area regarding external relations and its composition and to find the right formula for both function and form for the proposed area,
- schemes for the idea in a scales 1:10000, 1:5000 in a city context,
- the concept in a scale 1:2000 as a regulatory plan to outline the concept of open space /public to private/ and relationships between volumes and open spaces /plan, visualizations from bird's eye and the human eye level /for chosen urban interiors as a base for urban orientation//,
- plans, sections and elevations of the proposed fragments in a scale 1:500
- schemes, sketches, renderings and hand drawing showing the concept,
- thematic essay and a description of the project.

Literature: Basic literature on the subject of urban composition and design of residential complexes

Course type: Design studio - individual design work under supervision of a tutor

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Multifamily Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,

Contact person: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch., phone #: +48 12 628 24 30;
e-mail: akanta@poczta.onet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN - CENTRES AND CENTRAL AREAS**

Institute/Division: A3 Institute of Urban Design, Chair of Urban Renewal and Development

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Designing task addressed to the third year students is to prepare an urban concept design of the chosen area within the central area of Cracow. The design should provide a solution for an urban regeneration of the chosen area, including structural and functional aspects. It should also try to fill in empty areas (lots) within existing structures, providing new value in harmony with public spaces both in central and more peripheral areas of Cracow. To practice the knowledge acquired by the student during the previous period of study in the field of urban design and the regeneration of the existing city structure. To implement a new skill upon which a student can clearly and precisely articulate hers/his designing decisions with the strong accent placed upon local spatial conditions, urban composition, functional program and ecological values. To acquire the skill of proper graphic presentation (emphasizing the most important elements) of the design as well as the skill of the proper verbal presentation by taking part in class discussions

Literature: Basic literature on the subject to be given at the beginning of the course

Course type: Individual design work under supervision and tutorial

Assessment method:

- Participation in the design class
- Presence at the seminars
- Mid-semester presentation-review of the project
- Final public presentation of the project which includes: urban analyses and structure schemes in relation to the city centre (1:5000), urban project and model (1:2000), characteristic part of the proposed urban design (1:500), axonometric view, written description, architectural detail.

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Multifamily Housing)

Primary target group: 3rd year students in Architecture

Lecturer: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc, PhD, Arch..;

Tutors: Małgorzata Mizia, PhD, Arch , Krzysztof Kwiatkowski PhD, Arch.,

Contact person: Małgorzata Mizia, PhD, Arch.; phone #: +48 12 628 24 34; e-mail: mmizia@o2.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN C**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: The elaboration of the concept of urban design re. the programmatic and spatial transformations of an important yet degraded central urban area. The work has three phases:
1) introductory seminars presenting the chosen sites;
2) detailed urban design analysis (teamwork, which results are presented and can be compared and assessed in order to facilitate the choice of the site)
3) individual design work: ideas and their design interpretations in the following scales : 1:2000 (concept of relations to the larger context of the area), 1:1000 (detailed concept of revitalisation) and 1: 500 (detail of the proposed public space).
To master the fundamentals of the urban design, regarding the following:

- principles of composition of legible urban spaces inc. the existing values of the urban fabric
- principles of sustainable functional and spatial restructuring principles of creating of public spaces that enhance the identity of place;
- valid legal norms re. design in central urban areas and revitalization

To develop skills in:

- team work (urban design analysis as the basis of future design decisions)
- individual, creative and responsible design decisions in complicated urban locations

Literature: Basic literature on the subject of urban composition and urban renewal

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings, Public Use Buildings)

Primary target group: 3rd year students in Architecture

Lecturer: Anna Franta, Assoc. Prof. DSc PhD, Arch

Contact person: Anna Franta, Assoc. Prof. DSc PhD Arch.;
phone #: +48 12 628-24-70; e-mail: studio_ut@pk.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN D**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Projects in this course involve issues related to revitalization of downtown areas with specific emphasis on public space design. During the course there are 3 interim presentations and reviews, seminars and panel discussion jury. The first stage of the work is an urban analysis, which covers studies: on the existing spatial structure – its historic and compositional values, the public space network, the existing transportation system, social issues and the existing land ownership structure.
The analysis is presented on digital maps (1:5000), site visits are documented by report illustrated by photos and sketch drawings and an essay. The next step is an urban design concept for the chosen site within the analyzed area. The design contents and its notation correspond with

practices used by the local planning. Presentation of the urban concept consists of plans in 1:2000 and 3D illustrations of urban form. The final stage is aimed at the conceptual design of a selected public space. Its contents and presentation correspond to a typical site plan. Required are: ground level plan in 1:500 -ground floors of framing structures and open public space arrangement - sections in 1:200; selected facade based on students' research on urban detail aesthetics and a short text explaining the design idea and its evolution. At the end of the semester, the public presentation of the projects gives students the opportunity to explain and discuss their concepts.

Literature: To be given at the beginning of the course

Course type: Design studio

Assessment method: Timely submission of the design project, public presentation

Prerequisites: Architectural and Urban Design Studio

Primary target group: 3rd year students in Architecture

Project Guidance: Krzysztof Bieda, Prof. DSc PhD Arch.

Tutor: Kinga Racoń-Leja, PhD Arch.

Contact person: Kinga Racoń-Leja, PhD Arch.; phone #: +48 12 628-24-29; e-mail: krleja@pk.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN - REDEVELOPMENT OF A PART OF A CITY WITH PREVALENT SERVICE FUNCTION**

Institute/Division: A5 Institute of City and Regional Design; Division of Physical Planning and Environmental Protection

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: The semester work has to result in a concept design in an urban-architectural scale, presenting a legible vision of development of a selected part of a town – against the broader context. The scope of the context is delimited individually, according to the logic of spatial and functional relations. The definition of these relations is one of the tasks of the project.
The main tasks are:

- To create new compositional values and esp. to create attractive public spaces and arrangement of masses that enrich the skyline;
- To provide proper functional relations – adequate to the spatial programme
- To define – generally – the character of architecture of the designer complex in order to enhance the genius loci.

Literature: Basic literature on the subject of urban design

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation)

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 3rd year students in Architecture

Lecturer: Zbigniew Zuziak, Prof. DSc PhD Arch.

Contact person: Zbigniew Zuziak, Prof. DSc PhD, Arch.,
e-mail: a5-institute@pk.edu.pl or zzuziak@nsnet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF SERVICE AREAS**

Institute/Division: A5 Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Course code: I-C-22

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 90

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Within the frame of the course the students elaborate the design of a functional and compositional rebuilding of a part of a city in order to raise its functional value as well as the quality of life. On the basis of the provided land-surveying maps scale 1:2000 or 1:1000 , the use survey, own assessment of the quality of an urban space and spatial and functional regional connections (and other materials) for a selected town the students are expected to prepare:

- Synthesis of conditions of the area in question against the background of a city

and thence to propose

- The programmatic and spatial concept of the designed area in the scale of the provided map along with the sketches and working model , followed by: - A solution of a chosen part (1:500) with principles of solutions of an urban design detail and architectural –urban design solutions (plans, sections, sketches, perspectives)- The essay describing the consecutive parts of the project (elaborated parallel to the design work).

Literature: Basic literature on the subject of urban design

Course type: Individual design work under supervision and tutorial

Assessment method: Passing of the obligatory three design reviews, two drawing controls, elaboration of a design project and its jury.

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 3rd year students in Architecture

Lecturer: Prof. Elżbieta Węcławowicz-Bilska, DSc, PhD Arch. , Rafał Blazy PhD Arch., Anna Pawlak PhD Arch.

Contact person: Prof. Elżbieta Węcławowicz-Bilska, . DSc PhD Arch.
Phone #: +48 12 628-24-66;
e-mail; eweclaw@poczta.onet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES - URBAN RENEWAL**

Institute/Division: A3 Institute of Urban Design, Division of Urban Composition

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: This one-semester course is focused on the mastering of the design skills covering: - the problems of shaping, renewal and development of the contemporary city; methods of preparing land-use plan for the city as a legal basis for the development of municipal terrains; - methods of forming public spaces from plans to small scale urban and architectural details; methods of preparing zone plans for the renovation of the city central areas; methods of carrying out complex urban inventories. Process sketches and diagrams, plans, sections (scales: 1:10000, 1: 5 000, 1: 2 000, 1: 500)

Literature: Basic literature on the subject of urban composition and urban renewal

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Jacek Gyurkovich, Prof., DSc, PhD Arch.;

Tutors: Mateusz Gyurkovich, PhD, Arch.,
Wojciech Wicher, PhD Arch.,
Agnieszka Wójcik, PhD Arch.

Contact person: Agnieszka Wójcik, PhD Arch.; phone #: +48 12 628 24 28;
e-mail: aga_vv@op.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES - URBAN RENEWAL**

Institute/Division: Institute of Urban Design, Division of Urban Composition

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: This one-semester course is focused on the design skills mastering: the problems of shaping, renewal and development of the contemporary city; methods of preparing land-use plan for the city as a legal basis for the development of municipal terrains; - methods of forming public spaces from plans to small scale urban and architectural details; methods of preparing zone plans for the renovation of the city central areas; methods of carrying out complex urban inventories. Process sketches and diagrams, plans, sections (scales: 1:10000, 1: 5 000, 1: 2 000, 1: 500)
Particular attention is paid to the design by creating a well-composed urban form, complementary to an existing city or its part and to the skillful space organization to achieving a good space orientation.

Literature: Basic literature on the subject of urban composition and urban renewal

Course type: Design studio - individual design work under supervision of a tutor

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,

Contact person: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch., phone #: +48 12 628 24 30;
e-mail: akanta@poczta.onet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES**

Institute/Division: A3 Institute of Urban Design, Chair of Urban Renewal and Development

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: The design task encompasses the elaboration of the urban design concept of development and transformation of the chosen part of Cracow. The site is located in the central, attractive area, with the dominating service function. The design solutions are supposed to enhance the spatial order and harmony, and shall be based upon the programmatic and spatial solutions, conversion and filling the gaps in the existing urban fabric, as well as on redevelopment of the public space, incl. service functions, green areas, recreation and transport. The design method is based upon studies of composition, functional and spatial relations with the context: analysis of the existing fabric, transportation and circulation systems as well as the context of nature and culture. Pro-ecological solutions are preferred (energy-saving and sustainable design).

Literature: Basic literature on the subject to be given at the beginning of the course

Course type: Individual design work under supervision and tutorial

Assessment method: The condition of crediting the course is participation in the classes (design reviews, drawing controls), achieving a positive mark of the course work: presenting a design prepared in accordance with the required form, range and deadline, participation in the jury of the work.

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Single Family Housing, Architectural and Urban Design – Residential Complexes II)

Primary target group: 3rd year students in Architecture

Lecturer: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc, PhD Arch.

Contact person: Stanisława Wehle-Strzelecka, Assoc. Prof. DSc, PhD, Arch.; phone #: +48 12 628 24 34;
email: wehle@tlen.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES (URBAN RENEWAL)**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: This one-semester course includes issues of revitalization of downtown areas and is focused on the mastering of students' knowledge and design skills in:

- urban analysis by introduction of adequate tools useful in recognition of existing city structure (values and problems) and helpful in formulating design guidelines, that derive from context;

- preparing master plan for the renewal of city central areas presenting an idea of spatial and structural development searching for its sustainability;
- creating valuable public spaces through emphasizing proper relationship between public spaces and pieces of architecture as well as balancing both form and meaning to create compositional and interactive quality of space.

Process sketches, diagrams, plans, sections, models, 3D visualizations; scales: 1: 5000, 1: 2000, 1: 1000, 1: 500

Literature: Basic literature on the subject of urban composition and urban renewal

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings, Public Use Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Anna Franta, Assoc. Prof. DSc, PhD, Arch

Contact person: Anna Franta, Assoc. Prof. DSc, PhD, Arch.;
phone #: +48 12 628-24-70); e-mail: studio_ut@pk.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Projects in this course involve issues related to revitalization of downtown areas with specific emphasis on public space design. During the course there are 3 interim presentations and reviews, seminars and panel discussion jury.

The first stage of the work is an urban analysis, which covers studies:

- on the existing spatial structure – its historic and compositional values,
- on the existing public space network with streets and squares on the existing transportation system
- on social issues and
- on the existing land ownership structure.

The analysis is presented on digital maps (1:5000), site visits are documented by report illustrated by photos and sketch drawings and an essay. The next step is an urban design concept for the chosen site within the analyzed area. The design contents and its notation correspond with practices used by the local planning. Presentation of the urban concept consists of plans in 1:2000 and 3D illustrations of urban form. The final stage is aimed at conceptual design of selected public space. Its contents and presentation correspond to a typical site plan.

Literature: To be given at the beginning of the course

Course type: Design studio

Assessment method: Submission of the project, public presentation

Prerequisites: Architectural and Urban Design Studio

Primary target group: 4th and 5th year students in Architecture

Project Guidance: Krzysztof Bieda, Prof., DSc, PhD Arch.

Tutor: Kinga Racoń – Leja PhD Arch.

Contact person: Kinga Racoń – Leja PhD Arch.,
phone #: +48 12 628-24-29; email: krleja@pk.edu.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES**

Institute/Division: A5 Institute of City and Regional Design;
Division of Physical Planning and Environmental Protection

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Students are expected to outline a concept of a future development for selected urban area presenting a clear vision in which new masses creating urban space will be harmoniously integrated with existing values of urban structure. The concept should be based on the analysis of the following elements / factors:

- The role of selected area in the whole town and spatial values of the designated area;
- Functional and spatial / visual relations of the area selected for development with surrounding urban fabric.

The following tasks are particularly important as design criteria for assessing the student's project:

- Creating new aesthetic values such as attractive public spaces and the composition of masses enriching the skyline of the town;
- Ensuring appropriate functional relations respectively to the programmed uses of space;

- Defining the character of newly designed architecture so that it could be regarded as a creative interpretation of urban context.

Literature: Basic literature on the subject of urban design

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation)

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Zbigniew Zuziak, Prof., DSc, PhD Arch.

Contact person: Zbigniew Zuziak, Prof., DSc, PhD, Arch.,
e-mail: a5-institute@pk.edu.pl or zzuziak@nsnet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **URBAN DESIGN OF CITY CENTRES**

Institute/Division: A5 Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Course code: II-C-7

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 8

Course description: Students work on design concerning functional and compositional rebuilding of the chosen part of the city to upgrade city's functional and compositional values as well as quality of living standard in the city.
On the provided land-surveying plan, (1:2000 or 1:1000) with convenience of the student's own evaluation of the quality of cityscape and functional connections, students continue to work on:

- synthesis of conditions of the chosen area against the background of the city;
- design of chosen area, including functional and architectural concept, drawings, working model;
- layout (1:500) of the chosen part of the city showing urban detail solutions, and urban design and architectural concept – (plans, sections, sketches, perspectives);
- description of design stages completed during the semester.

Literature: Basic literature on the subject of urban design

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and written presentation)

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighbourhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Prof. Elżbieta Węcławowicz-Bilska, DSc, PhD Arch.
Rafał Blazy PhD Arch.

Contact person: Prof. Elżbieta Węcławowicz-Bilska, . DSc PhD Arch.
Phone #: +48 12 628-24-66;
e-mail; eweclaw@poczta.onet.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN – DESIGN STUDIES: THE SEARCH FOR AN ARCHITECTURAL PRETEXT**

Institute/Division: A2 Institute of Architectural Design, Chair of Housing

Course code: C4-7

Erasmus subject code: 02-1

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: An application of a project in an existing area:

- the research on “urban motivations” and “architectural pretexts” of the object and its location (chosen by a student according to his/her individual preferences);
- theoretical models of spatial thinking;
- the painted notation of the project's idea: an axonometrical view, a perspective;
- an essay on the theoretical basis of the concept.

Literature: Literature on architectural composition and the design of housing architecture; architectural magazines.

Course type: Individual design work under supervision and tutorial.

Assessment method: Submission of the prepared design and the essay.

Prerequisites: Architectural and Urban Design Studio

Primary target group: 5th year students in Architecture

Lecturer: Dariusz Kozłowski, Prof., DSc, PhD Arch.

Contact person: Ernestyna Szpakowska, PhD, Arch.,
e-mail: ernestynaszpakowska@gmail.com, phone #: +48 12 628-20-21

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN – DESIGN STUDIES OF FORM, FUNCTION AND STRUCTURE**

Institute/Division: A2 Institute of Architectural Design, Division of Architectural Composition

Course code: C4-7

Erasmus subject code: 02-1

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: Preparation for the diploma project:

- looking for the "urban motivation" and "architecture pretext" for the diploma project theme and setting, chosen by the student according to his/her individual interests;
- theoretical grounds of conception with short technical specification of the object;
- theoretical studies accompanied by design;
- preparation of an example of a project in existing area;
- theoretical models of thinking;
- notation of the project idea: axonometric view, perspective, project introduction in permanent technique;
- essay on theoretical grounds of conception with short technical specification of a building.

Literature: Literature on the subject of architectural composition and the design of housing architecture; architectural magazines

Course type: Individual design work under supervision and tutorial

Assessment method: Submission of prepared design and essay

Prerequisites: Architectural and Urban Design Studio

Primary target group: 5th year students in Architecture

Lecturer: Maria Misiągiewicz, Prof., DSc, PhD Arch.

Contact person: Mariusz Twardowski, PhD, Arch., phone #: +48 12 628 2021 29
email: mt@twardowskiwokan.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN - URBAN DESIGN**

Institute/Division: A3 Institute of Urban Design, Division of Urban Composition

Course code: C4-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: Course allows to broaden and improve students' skills and knowledge in the field chosen for the diploma project; it prepares students to elaborate the diploma work on both theoretical and practical level. The choice of the design task and its location depends on the student.

Selected questions coming from an urban analysis (which covers urban history of the area, urban inventory, drawing and photographic material) form the first stage of student's work. They become the starting point for the further analysis, such as structure, composition of space, transportation and function which help to formulate possible urban policies for the prepared design.

The next stage is to prepare a regulation plan and axon (1:2000) presenting the idea of spatial and functional development of the area considered as a part of a larger existing town structure.

An obligatory essay consists of a short description of several examples of urban intervention in city structure with drawings and schemes (prepared at the first stage) and of an idea and technical description of a prepared design.

Literature: Basic literature on urban composition and urban renewal

Course type: Design studio organized in a form of group and individual consultations + 2 mid-semester reviews

Assessment method: Evaluation of the final submission

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Public Use and Residential Buildings, Urban Renewal)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Jacek Gyurkovich, Prof., DSc, PhD Arch.;

Tutors: Mateusz Gyurkovich, PhD, Arch.,
Wojciech Wicher, PhD Arch.,
Agnieszka Wójcik, PhD Arch.;

Contact person: Agnieszka Wójcik, PhD Arch.; phone #: +48 12 628 24 28;
e-mail: aga_vv@op.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN - URBAN DESIGN**

Institute/Division: Institute of Urban Design, Division of Urban Composition

Course code: C4-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: Course allows to broaden and improve students' skills and knowledge in the field chosen for the diploma project; it prepares students to elaborate the diploma work on both theoretical and practical level. The choice of the design task and its location depends on the student.
Selected questions coming from an urban analysis (which covers urban history of the area, urban inventory, drawing and photographic material) form the first stage of student's work. They become the starting point for the further analysis, such as structure, composition of space, transportation and function which help to formulate possible urban policies for the prepared design.
The next stage is to prepare a regulation plan and axon (1:2000) presenting the idea of spatial and functional

development of the area considered as a part of a larger existing town structure.
An obligatory essay consists of a short description of several examples of urban intervention in city structure with drawings and schemes or an essay on a chosen urban problem and of an idea and technical description of a prepared design.

Literature: Basic literature on urban composition and urban renewal

Course type: Design studio - individual design work under supervision of a tutor

Assessment method: Evaluation of the final submission (process, progress, personal creativity & individual approach, graphic and oral presentation)

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Public Use and Residential Buildings, Urban Renewal)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch.,

Contact person: Anna Agata Kantarek, Assoc. Prof., DSc, PhD, Arch., phone #: +48 12 628 24 30;
e-mail: akanta@poczta.onet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN - URBAN DESIGN**

Institute/Division: A3 Institute of Urban Design, Division of Public Spaces for Movement

Course code: C4-7

Erasmus subject code: 02.1 / 02.3

Number of contact hours: 60

Course duration: 1 semester (Fall Semester)

ECTS credits: 6

Course description: The course intends to broaden students' knowledge and to perfect their skills in solving design problems in a selected area. The project and the site are determined by the student's interest and his/her supervisor's agreement. It should be thematically related to the diploma project and provide a broader theoretical and urban context. First stage of the project is an urban analysis of the area. It investigates the existing development (through drawing and photo-graphic inventory), building structure, urban composition, present uses and transport system. The outcome of the analysis allows to determine conditions for future development and to formulate design guidelines for the site. In the second stage of the project students outline their urban design concepts. Important design criteria are: urban context, links with the surrounding network of public spaces, contribution of the proposed development to overall urban quality and its environmental impact. In the written component the student presents his/her idea and the project description.

Literature: Basic literature on the subject of urban design and urban rehabilitation:

- Kostof Spiro, The City Shaped, Thames and Hudson Ltd., London 1991;
- Girouard Mark, Cities and People, Yale University Press, New Haven and London 1985;
- Jacobs Allan B., Great Streets, The MIT Press, Cambridge, London 1995;
- Trancik Roger, Finding Lost Space, Van Nostrand Reinhold, New York 1986;
- Broadbent G., Emerging Concepts in Urban Space Design, E & FN Spon, London 1996
- Lynch Kevin, The Image of the City, The MIT Press, Cambridge 1990;
- Cullen Gordon, The Concise Townscape, The Architectural Press, London 1986;
- Mitchell William J., E-topia, The MIT Press, Cambridge and London 1999;
- Mitchell William J., City of Bits, The MIT Press, Cambridge and London 1999;

- Carmona Matthew, Heath Tim, Oc Taner, Tiesdell Steve, Public Places Urban Spaces, Architectural Press, Oxford 2003;
- Gehl Jan, Life Between Buildings, The Danish Architectural Press, 2010;
- Palej Anna, Miasta cywilizacji informacyjnej. Poszukiwanie równowagi pomiędzy światem fizycznym a światem wirtualnym, Wydawnictwo Politechniki Krakowskiej, Kraków 2004;
- Franta Anna, Reżyseria przestrzeni. O doskonaleniu przestrzeni publicznej miasta, Wydawnictwo Politechniki Krakowskiej, Kraków 2004;

Course type: Design studio organized in a form of group and individual tutorial, presentations and discussions.

Assessment method: Evaluation of the final submission

Prerequisites: Architectural and Urban Design Studio (e.g. Urban Composition, Public Use and Residential Buildings, Urban Renewal)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Krzysztof Bieda, Prof., DSc, PhD, Arch.;
Anna Franta, Assoc. Prof., DSc, PhD Arch.
Anna Palej, Assoc. Prof., DSc, PhD Arch.

Contact person: Anna Franta, PhD, Arch.; phone #: +48 12 628-24-70; e-mail: studio_ut@pk.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN – URBAN AND ENVIRONMENTAL PROTECTION**

Institute/Division: A5 Institute of City and Regional Design;
Division of Physical Planning and Environmental Protection

Course code: C4-7

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: The student can choose his/her project theme from the following thematic groups:

- Redevelopment/regeneration of the inner city area and urban revitalization strategies with particular reference to the “close-to-station-areas” and the network of public spaces related to “the architecture of travel”;
- Projects for spatial development of the areas related to heritage trails and significant tourist areas in Southern Poland;
- Spatial development of selected urban area in the context of development guidance, derived structural spatial development plans (mainly the projects that can be regarded as potential “flagship projects”).

Tasks:

- Defining the problem and its contexts;
- Inspirations (artistic, from plastic art, literature and music) and interpretation of site /place specific values;
- Working out individual project design methodology;
- Vision of possible spatial solutions and its artistic interpretation.

Literature: Basic literature on urban design

Course type: Individual design work under supervision and tutorial

Assessment method: Individual presentation for a tutor

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Zbigniew Zuziak, Prof., DSc, PhD Arch.

Contact person: Zbigniew Zuziak, Prof., DSc, PhD, Arch.,
e-mail: a5-institute@pk.edu.pl or zzuziak@nsnet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **SPECIAL TOPICS DESIGN – TOWNS, SPATIAL AND REGIONAL PLANNING, HEALTH RESORTS AND SPA PLANNING**

Institute/Division: Institute of City and Regional Design; Chair of Spatial Planning and Environment Protection

Course code: C4-7

Erasmus subject code: 02.1 / 02.3 / 02.4

Number of contact hours: 60

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: Each student can choose the subject of project from the following group of selected issues:

- Recreation and spa areas in metropolis, cities and towns;
- Existing and new spas and health resorts;
- Redevelopment areas in centers of big and medium cities;
- Spatial development of heritage and natural values areas specially in regions of South Poland.

Course focuses on practical problems occurring in design process in the disciplines of urban design, spatial planning, regional planning, tourist, leisure, spa and resort planning; each design is preceded by the definition of natural, cultural and social aspects. Individual preliminary studies are based on limited area regional scale or local plan design.

Literature: Basic literature on urban design and on the chosen subject:

- Arieff, B. Burkhart Spa ,Taschen Koln 2005
- Spa Beauty, Health & Design, (Editor: Paco Asensio) Loft Publication Barcelona 2007
- Spa Design, Daab Cologne, London, New York 2006

Course type: Individual design work under supervision and tutorial

Assessment method: Execution of design and its public defense

Prerequisites: Urban Design Studio (e.g. Urban Composition, Residential Neighborhoods, Residential Buildings)

Primary target group: 4th and 5th year students in Architecture

Lecturer: Prof. Elżbieta Węcławowicz-Bilska, , DSc, PhD Arch.

Wojciech Wójcikowski, PhD, Arch.

Contact person: Prof. Elżbieta Węcławowicz-Bilska, PhD. DSc, Arch.,
phone #: +48 12 628-24-66;
e-mail; eweclaw@poczta.onet.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

LANDSCAPE ARCHITECTURE DESIGN – INTEGRATED DESIGN STUDIOS

COURSE TITLE: **PRIVATE GARDEN (INTEGRATED DESIGN STUDIO 2)**

Institute/Division: A8 Institute of Landscape Architecture, Section of Landscape Composition and Planning

Course code: WA AK o1S C1a 12/13, WA AK o1S C1b 12/13

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 7

Course description: The design of layout and arrangement of private garden at a detached house plot, multifamily house backyard or kindergarten

During the semester course students prepare several sequential parts of design:

- pavements and surfaces for pedestrians and cars (scale 1:100, 1:200), details (1:20, 1:10, 1:5)
- the fence with wicket and gate (scale 1:100, 1:200), details (1:20, 1:10)
- the refuse heap (scale 1: 50), details (1:20, 1:10, 1:5)
- site plan of the fragment of the garden with an architectural object (i.e. terrace, garden pond, recreational area, play equipment, etc) and special consideration of landform and vegetation in spring and autumn color version (scale 1:50, 1:20)
- final project of the whole garden integrating all designed elements (scale 1:100, 1:200)

The project is integrated with other courses e.g. building construction, CAD, plant material and freehand drawing.

Literature: Basic literature on landscape design and on the chosen subject:

- Ernst Neufert, *Podręcznik projektowania architektoniczno-budowlanego*, Arkady, Warszawa 2003 (also in English version),
- coedit. Charles W. Harris, *Time-saver standards for landscape architecture: design and construction*, New York 1988
- Magazines in English: Landscape Architecture, Topos

Course type: Individual design work under supervision and tutorial

Assessment method: Project completion

Prerequisites: Consultation in the field of natural vegetation and plant cover

Primary target group: Landscape Architecture course – 2nd semester of graduate studies

Lecturer: Agata Zachariasz Ph D. Arch. University Professor; Izabela Sykta Ph D. Arch. Assistant Professor

Contact persons: Agata Zachariasz, phone 012 628-24-92,
e-mail – azachar@pk.edu.pl
Izabela Sykta, phone 012 628-24-92,
e-mail – isykta@pk.edu.pl
Joanna Szwed, phone 012 628-24-36,
e-mail – jszwed@autograf.pl
Martyna Klimkiewicz, phone 012 628-24-92,
e-mail – martyna.klimkiewicz@gmail.com

Deadline for application: beginning of the Spring semester (according to the schedule)

Remarks: The design tasks (plots) are different in each semester

COURSE TITLE: **URBAN PUBLIC SPACE – STREET& SQUARE (INTEGRATED DESIGN STUDIO 3)**

Institute/Division: A8 Institute of Landscape Architecture, Study for Cultural Architeundations of Landscape Architecture

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Fall Semester)

ECTS credits: 9

Course description The topic of design is an urban enclosure: a square, city street in their broader context respecting composition and visual relations with other neighbouring enclocures:

- General concept of square or street composition within their context (scale 1:500), inventory of the present state, planting plan and management, preliminary design - plans and axonometric view
- Underground passage with green lid construction (scale 1:500 and 1:200, plans and sections, with details)
- Square design (scale 1:200), paving and plastering, street furniture (scale 1:20 or 1:10), specification of plants
- Detail design (optional) - bus shelter, kiosk, statue, fountain (scale 1:50 or

1:20) plans, sections, views and perspective drawings

Literature

- Katalog roślin II - drzewa, krzewy, byliny polecane przez Związek Szkółkarzy Polskich**,** Agencja Promocji Zieleni, Warszawa 2003
- Time-saver standards for landscape architecture: design and construction, coedit. Charles W. Harris, New York 1988
- Gordon Cullen, The Concise Townscape, London 1977

Course type: design studio

Assesment method : project completion

Primary target group Landscape Architecture course – 3rd semester of graduate studies

Lecturer: Assoc. Prof. Krystyna Dąbrowska Budziło D. Sc., Ph. D. Arch.

Tutors: Anna Staniewska, PhD Arch.,
Jacek Konopacki, MSc. Landscape Architect

Contact person: Anna Staniewska, PhD Arch,
phone #: +48 12 628 24 91;
e-mail: astaniewska@pk.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

COURSE TITLE: **REVALORIZATION OF HISTORIC GARDENS (INTEGRATED DESIGN STUDIO 4)**

Institute/Division: A8 Institute of Landscape Architecture,

Course code: WA AK o2S C5a 12/13, WA AK o2S C5b 12/13

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 9

Course description The topic of design is an monastic complex.
During the semester course students prepare 5 sequential part of designs:

- Analysis of accessibility to monastic enclosures and their spatial context.
- Historic studies - phases of spatial development.
- Function of pilgrims shrine.
- Revalorisation of (*viridarium*) *hortus conclusus* (the Middle Ages), monastic garden (the Renaissance), "Paradise Courtyard" (the baroque)
- Garden architecture

Literature Basic literature on garden design and revalorization:

- Aleksander Böhm, Agata Zachariasz, *Architektura krajobrazu i sztuka ogrodowa : ilustrowany słownik angielsko-polski, Landscape architecture and art of gardening : the illustrated English-Polish dictionary*. Vol. 1. a-d , Warszawa 1997, Vol. 2. e-j, Warszawa 2000, Vol 3. k-q Warszawa 2005
- Magazines: German - „Garden und Landschaft", English: „Landscape Architecture", Polish: „Ogrody, ogródki, zieleńce"

Course type: design studio

Assesment method: project completion

Primary target group: Landscape Architecture course – 4th semester of graduate studies

Lecturer: Prof. Anna Mitkowska, D. Sc., Ph. D. Arch.

Contact person: Katarzyna Hodor, phone 012-628-24-64,
e-mail - kasiahodor@interia.pl

Deadline for application: beginning of the Spring semester (according to the schedule)

COURSE TITLE: **PUBLIC PARK (INTEGRATED DESIGN STUDIO 5)**

Institute/Division: A8 Institute of Landscape Architecture, Study for Cultural Architeundations of Landscape Architecture

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Fall Semester)

ECTS credits: 11

Course description: The course exposes students to real-world situation of designing a public park in Kraków or direct neighborhood where creative activity and basic independent landscape research is expected. The site is each year different for design is based on the results of social research (public participation workshop is part of the course).

The project has to take into account the needs of various user groups of a land area. Designed park space should be created as a meaningful public space universally accessible in all terms and engaging visitors of diverse ages, backgrounds and interests.

Moreover, the course offers an opportunity to develop an understanding of the sensory, visual and functional importance of plants in the landscape. Basic information on visualization and design of planted landscapes is given together with the advice on development of draft planting plans.

The project idea should be expressed through graphic media and the use of drawing techniques for visual representation, including plans, sections, and axonometric drawings with necessary technical details where appropriate. Both free-hand drawing and computerized drafting and drawing are encouraged.

Scope of the project: Landscape architectural project - plan in 1:500 (1:1000), sections, projects of objects (pavilions, bridges etc. – scale 1:100 or 1:50), small architecture, landmarks, planting concept, a brief summary about the project

Literature:

- Astrid Zimmermann, 'Constructing Landscape', Birkhauser 2011, http://issuu.com/birkhauser.ch/docs/constructing-landscape
- Bradley Cantrell,Wes Michaels, ‘Digital Drawing for Landscape Architecture’, Wiley 2010

- Frederick Steiner, ‘The Living Landscape’, IslandPress 2008
- John Benson, ‘Landscape and Sustainability’, 2001

Course type: Individual design work under supervision and tutorial, participation in participative planning workshop, an on-site visit, short introductory seminars

Assessment method: Participation in the course and design – reviews; submission and evaluation of the completed project

Prerequisites: Basic knowledge of the (landscape) architectural design, basic drawing skills

Primary target group: 3rd year students in Architecture and Landscape architecture

Lecturer: Krystyna Pawłowska, Prof. Arch.

Tutors: Anna Staniewska, PhD Arch.,
Jacek Konopacki, MSc. Landscape Architect

Contact person: Anna Staniewska, PhD Arch,
phone #: +48 12 628 24 91;
e-mail: astaniewska@pk.edu.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

Remarks: The design tasks are preceded by social research and are different in each year

COURSE TITLE: **POST- INDUSTRIAL AREAS (INTEGRATED DESIGN STUDIO 6)**

Institute/Division: A8 Institute of Landscape Architecture

Course code:

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Spring)

ECTS credits: 9

Course description

- Study of landscape enclosures for the chosen post-industrial area
- Preliminary design of master plan for post-industrial park
- A concept design of part of park
- A birds–eye view perspective of master plan conception
- Presentation techniques of design concept

Literature

- Time-saver standards for landscape architecture: design and construction, coedit. Charles W. Harris, New York 1988
- Magazines – in English - Topos, in Polish – Murator

Course type: design studio

Assessment method: project completion

Primary target group: Landscape Architecture course – 6th semester of graduate studies

Lecturer: Krzysztof Wielgus PhD. Arch.

Contact person Krzysztof Wielgus PhD. Arch.

COURSE TITLE: **COMPOSITION IN OPEN LANDSCAPE (INTEGRATED DESIGN STUDIO 7)**

Institute/Division: A8 Institute of Landscape Architecture, Chair of Landscape Architecture Design

Course code:

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Fall or Spring)

ECTS credits: 7

Course description: The project is carried out in the suburbs or rural areas with high landscape and / or cultural and natural values. Design area covers few to several hundred hectares. Throughout the course, students perform digital terrain model on which the landscape analysis is conducted utilizing ray-tracing method. On the maps of the area, the students develop an analysis of the historical and natural resource. Based on the self-prepared analyzes, the student prepares guidelines for the project. The course project includes the development of the master plan of project area on a scale of 1:1000 - 1:5000, depending on the subject and a detailed project on a scale of 1:500 or 1:1000. For each scale visualizations are made from human level and birds' eye view.
Theme of the project envisages development of the area for recreational / sports utilities. Aspects of protection of existing cultural, landscape and natural values of the area should be taken into account the project.

Literature: Depending on the design task

Course type: Individual design work under supervision and tutorial

Assessment method: Evaluation of the final submission as well as process, progress, personal creativity & individual approach, graphic and oral presentation; final presentation: 4 charts 100 x 70 cm + freehand drawing and 10 min oral presentation

Prerequisites: Skilled operation of CAD-systems (focus on Autodesk Civil 3D), Sketchup, Photoshop, freehand drawing; landscape understanding; basic knowledge of plants and plant communities

Primary target group: 3rd, 4th, and 5th year students in Landscape Architecture and Architecture

Lecturer: Wojciech Kosiński, Prof., DSc, PhD Arch.

Tutor: Przemysław Kowalski, PhD

Contact person: Przemysław Kowalski, PhD,
phone #: +48 12 628-25-65; e-mail: pmkowal@interia.pl

Deadline for application: beginning of the Fall or Spring semester (according to the schedule)

COURSE TITLE: **PHYSICAL PLANNING - LANDSCAPE ASPECTS IN SPATIAL PLANNING (INTEGRATED DESIGN STUDIO 8)**

Institute/Division: Institute of Landscape Architecture, Section of Landscape Composition and Planning

Course code: WA AK o2S C5a 12/13, WA AK o2S C5b 12/13

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Fall)

ECTS credits: 7

Course description: The course subject is a project of a master plan of a given area within Cracow territory or the closest neighborhood, with a special consideration of landscape aspects and open space systems.

- Topic 1 – inventory of existing state of area, visual and landscape composition analysis including panoramic views and assessment (scale 1:2000)
- Topic 2 – detailed studies and analysis conducted in branch domains, concerning relief, vegetation cover, hydrology, visual and composition aspects, history of place and previous plans, technical infrastructure, present and future land use and land

property structure. The studies are based on: Atlas of Cracow (1988), Cracow Master Plan (1994), Cracow Current Condition and Physical Development Study (2003) and others, e.g. information obtained in district councils (scale 1:5:000, 1:10000)

- Topic 3 – project of the area master plan including characteristic sections of streets and public spaces with the arrangement of their surroundings, parameters of street infrastructure and buildings – text and the plan drawing (scale 1:2000)

Literature: Basic literature in landscape planning:

- Simon Bell, *Elements of visual design in the landscape*, E & FN Spon, London 1993
- Kevin Lynch, *Image of the City*, all editions
- John L. Motloch, *Introduction to landscape design*, New York 2001
- Christopher Alexander [et al.] *A pattern language: towns, buildings, construction*. Vol. 2, all editions
- Magazines - Topos, Landscape Research, Landscape and Urban Planning

Course type: Design work in two-persons' teams under supervision and tutorial

Assessment method: project completion; pass of the tests of the legal aspects of spatial planning and urban analysis

Prerequisites: Attendance in the lectures of Spatial Planning

Primary target group: Landscape Architecture course – 2nd semester of 2nd level studies

Lecturer: Prof. Aleksander Böhm, D.Sc. Ph.D. Arch.;
Agata Zachariasz, D.Sc., Ph.D. Arch. University professor

Contact person: Aleksander Böhm, phone 012 628-24-36,
e-mail – abohm@wp.pl
Agata Zachariasz, phone 012 628-24-92,
e-mail – azachar@pk.edu.pl
Izabela Sykta, phone 012 628-24-92,
e-mail – isykta@pk.edu.pl
Joanna Szwed, phone 012 628-24-36,
e-mail – jszwed@autograf.pl
Martyna Klimkiewicz, phone 012 628-24-92,
e-mail – martyna.klimkiewicz@gmail.com

Deadline for application: beginning of the Fall semester (according to the schedule)

Remarks: The design tasks (areas) are different in each semester.

COURSE TITLE: **PHYSICAL PLANNING – PLANS OF PROTECTION (INTEGRATED DESIGN STUDIO 9)**

Institute/Division: Institute of Landscape Architecture

Course code:

Erasmus subject code:

Number of contact hours: 105

Course duration: 1 semester (Fall)

ECTS credits: 7

Course description: The topic of design is protection plan for national park, landscape park, nature reserve or cultural park. The semester cycle is divided into fifth sequential tasks as follows:

- Operate of landscape values
- Nature reserve, part of national park or landscape park, park of culture, nature – landscape complex, object listed in UNESCO World Heritage
- Landscape of chosen area and analysis of basic materials
- A study of visual values
- Card index of the landscape standards
  A – plate and text of protection plan
  B – the guidelines for spatial management and administration of site

Literature:

- Instrukcja tworzenia parków kulturowych - http://www.kobidz.pl/app/site.php5/Show/330.html
- Kształtowanie krajobrazu a ochrona przyrody / wybór z 4-tomowej pracy zbiorowej w jęz. niem. pod red. Konrada Buchwalda, Wolfganga Engelhardta, uzup. pracami pol. aut. ; przekł. i oprac. pod red. Zygmunta Obmińskiego ; przekł. Eugeniusz Bernadzki, Stanisław Kasprzyk, Bogusław Lebelt ; oprac. Andrzej Samuel Kostrowicki [et al.], Warszawa : Państ. Wydaw. Rolnicze i Leśne, 1975
- Zbigniew Myczkowski, Krajobraz wyrazem tożsamości w wybranych obszarach chronionych w Polsce, Kraków 1998, second edition Kraków PK, 2003
- Krystyna Pawłowska, Idea swojskości miasta, Kraków PK, 2001
- Krystyna Dąbrowska-Budziło, Treść krajobrazu kulturowego w jego kształtowaniu i ochronie, Kraków PK 2002
- Magazines: In English - Landscape Reserch, in Polish - Aura, Wiadomości Konserwatorskie

Course type: design studio

Assessment method: project completion

Primary target group: Landscape Architecture course – 9th semester of graduate studies

Lecturer: Assoc. Prof. Zbigniew Myczkowski, Dsc. PhD. Arch.

Contact person Urszula Forczek-Brataniec, phone 012-628-24-65, e-mail urszulafb@interia.pl

Deadline for application: beginning of the Fall semester (according to the schedule)

Cracow University of Technology

Faculty of Civil Engineering

PROGRAMMES AND COURSES
IN ENGLISH

Offer for 2013/2014 Academic Year

The courses will open provided that there is sufficient student interest.

Lectures system:
L - lectures
Cl. - classes
Lab. - laboratory classes
P – projects
S- seminary

PROGRAM TITLE:	**COMPUTATIONAL ENGINEERING – GRADUATE STUDIES QUALIFYING FOR MSC DEGREE IN CIVIL ENGINEERING**
Erasmus subject code:	06.4
Duration:	3 semesters (beginning in March)
ECTS credits:	3 x 30
Program description:	Besides the courses typically taught at civil engineering graduate studies, like Mechanics of Materials and Structures, Advanced Reinforced Concrete Design, Advanced Steel Design, we offer courses focusing on computer aided engineering. These special courses include: Computer Aided Design, Numerical Methods, Finite Element Method, Algorithms and Data Structures, Selected Topics in Computer Sciences, Computer Graphics, Linear and Nonlinear Programming, Introduction to Artificial Intelligence.
Web page:	http://www.L5.pk.edu.pl, Institute for Computational Civil Engineering
Eligibility/Admission:	undergraduate degree (BSc) in civil engineering
Fees:	3 x 3 000 Euro
Contact person:	*Prof. Witold Cecot, Ph.D., D.Sc.,* *phone: +48 12 628 21 67* e-mail: plcecot@cyf-kr.edu.pl

Application procedures & deadlines:
deadline for application – May 15

- notification of preliminary acceptance – May 31
- payment of tuition for the first semester – June 30
- either final notification of acceptance or refund of the payment if the number of candidates is less than 15
- tuition payment due dates for each following semester is January 31 or August 31
- for the list of required documents and other details see http://www.bwm.pk.edu.pl

Remarks:	Students lacking required level of knowledge in the areas listed under Program Description may attend preparatory course during the preliminary semester (beginning in October, application deadline June 30).

CURSE TITLE: **APPLICATIONS OF MATLAB IN SCIENCE AND ENGINEERING**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 15

Course duration: 1 semester

ECTS credits: 1

Course description: The objective of the course is to provide students with a knowledge of certain, useful for engineers, applications of MATLAB environment to numerical modeling. The course is focused on: symbolic operations, including linear algebra, algebraic and differential equations, integration; graphics and visualization in 2D and 3D; a plane stress and a plane strain problems; PDE toolbox; dynamic analysis of selected structures; basis of statistics; animation possibilities.

Text books: B. R. Hunt, R. L. Lipsman, J. M. Rosenberg: A Guide to MATLAB: For Beginners and Experienced Users, Cambridge University Press, 2001.
A. Quarteroni, F. Saleri: Scientific Computing with MATLAB and Octave, Springer, 2006.

Course type: Lab sessions

Assessment method: Laboratory assignments and own presentation

Prerequisites: Matlab fundamentals

Primary target group: Undergraduate and graduate students of engineering

Instructors: Marta Serafin, Witold Cecot

Contact person: Marta Serafin, mserafin@L5.pk.edu.pl

Deadline for application: June 30 or November 30

CURSE TITLE: **ARCHITECTURAL ACOUSTICS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: This one semester course is focused on fundamental architectural acoustics issues. It introduces participants to acoustical theories, room design procedures and practical measurements methods. Students will learn how to design rooms for speech and music, including auditoria, concert halls, multipurpose rooms and places of worship. Expertise gained during this course gives a base for designing building projects with a satisfactory level of acoustical comfort in rooms. This means that additionally to building acoustical requirements of noise control and proper sound insulation the building interiors, room geometry and internal room surfaces should create acoustics adapted to the room function. This course also enables the participants to evaluate possible solutions to typical room acoustical problems like extensive reverberation, echo or flutter.
Content: Basic concepts and definitions in room acoustics; Human hearing mechanism; Reflection, absorption, transmission and diffusion of sound; sound absorbing materials - panel, resonance and porous absorbers; sound diffusing elements; Reverberation time; Sound clarity; Sound strength; Perception of sound envelopment and spaciousness; Design of rooms for speech; Design of rooms for music; Design of rooms for multi-purpose; Room acoustical measurements; Site visits;

Text books:
H. Kuttruff, 1991. *Room acoustics*. Elsevier Applied Science;
F. Makeawa, P.Lord, 1993. *Environmental and architectural acoustics*. E&FN Spon;
M. Barron, 1993. *Auditorium acoustics and architectural design*. E&FN Spon;

Course type: 15L + 30P

Assessment method: Attendance, evaluation of completed exercises, presentation of final design work

Prerequisites: Knowledge of general building constructions. Basic drawing skills.

Primary target group: 3rd, 4th and 5th year Architecture and/or Civil Engineering students

Instructors: Andrzej K. Kłosak, PhD. MSc. Ing. Arch.

Contact person: Andrzej K. Kłosak, PhD. MSc. Ing. Arch.;
phone #: (+48 12) 628 21 49;
e-mail: andrzej.klosak@pk.edu.pl

Deadline for application:

CURSE TITLE: **BRIDGE STRUCTURES**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 4

Course description: **Lecture:** Basic definition and terminology used in bridge engineering (components of bridges, function of main components, major types and structural systems of bridges, accessory of bridges). History of development of bridges. Conventional and new materials in bridge engineering. Methods of brides erection. Bridges live loads. Methods of calculation of bridges load capacity.
Design exercises: Project of beam bridge (conceptional drawings of the bride, static and load capacity calculation of the bridge – strength and reinforcement of deck slab and main girder).

Text books:

1. Furtak K. Wstęp do projektowania mostów, Politechnika Krakowska, 1999 r.
2. Leonhardt F.: Podstawy budowy mostów betonowych, WKŁ, Warszawa, 1982 r.
3. Kmita K.: Mosty betonowe. Cz I i II. Inżynieria komunikacyjna. WKŁ, Warszawa, 1984 r.
4. Madaj A., Wołowicki W.: Mosty betonowe, wymiarowanie i konstuowanie. WKŁ, Warszawa 1998 r.
5. Madaj A., Wołowicki W.: Podstawy projektowania budowli mostowych", WKŁ, Warszawa, 2003 r.
6. Furtak K.: Mosty zespolone, PWN, 1999 r.
7. Furtak K.: Podstawy mostów zespolonych. Podręcznik akademicki. Politechnika Krakowska, 1999 r.
8. Wołowicki W., Ryżyński A. i inni: Mosty stalowe, PWN, Warszawa-Poznań, 1984 r.
9. Biliszczuk J. Mosty podwieszone. Projektowanie i realizacja, Arkady, 2005 r.

Course type: 30 L + 30 P

Assessment method: Lecture and exercises attendance, execute of design exercise, final written examination.

Prerequisites:

Primary target group: First cycle programme

Instructors: M. Pańtak, Ph.D., tel. 628 29-13,
email: mpantak@pk.edu.pl

Contact person: M. Pańtak, Ph.D., tel. 628 29-13,
email: mpantak@pk.edu.pl

Deadline for application:

CURSE TITLE: **BUILDING ACOUSTICS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: This one semester course is focused on fundamental building acoustics issues. It introduce participants to acoustical theories and practical methods in building acoustics, including room acoustic and sound insulation, and thereby gives a background for designing and supervising building projects with a satisfactory level of acoustical comfort. This means that the building should be designed and constructed in a way that external and internal noise is eliminated. And also that the room geometry and internal room surfaces should be designed to optimise the acoustical conditions according to the function of room. This course also enables the participants to evaluate possible solutions to typical noise problems in the area of room acoustics, sound insulation or environmental noise.
Content: Basic concepts and units in building acoustics; Human hearing mechanism; Reflection and absorption of sound; Transmission of sound in buildings; Air-borne sound insulation; Impact sound insulation; Sound insulation from external noise sources; Flanking sound transmission; Acoustical characteristics of traditional and modern partition systems; Building acoustics standards; Types of sound absorbing materials - panel, resonance and porous absorbers; The insulation of buildings from

external noise; Reverberation time; Design of rooms for speech; Design of rooms for music; Design of rooms for multi-purpose;

Text books: H. Kuttruff, 1991. Room acoustics. Elsevier Applied Science;
F. Makeawa, P.Lord, 1993. Environmental and architectural acoustics. E&FN Spon;
M. Barron, 1993. Auditorium acoustics and architectural design. E&FN Spon;

Course type: 15 L + 30 Lab.

Assessment method: Attendance and evaluation of completed exercises
Knowledge of building construction, materials and structures, basic knowledge of mathematics and physics.

Prerequisites:

Primary target group: 3rd, 4th and 5th year Civil Engineering and/or Architecture students

Instructors: Andrzej K. Kłosak, Ph.D. Arch.

Contact person: Andrzej K. Kłosak, Ph.D. Arch.; phone +48 12 628 21 49, e-mail: andrzej.klosak@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **BUILDING MATERIALS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 60

Curse duration: 2 semesters

ECTS credits: 3

Course description: This one-term course focuses on:
1. presentation of production, properties and application of construction materials

(stone, ceramics, timber), thermal and water insulation materials as well as mineral binders (lime, plaster, cement),

2. discussion on durability of building materials with regard to the effect of environment on properties of materials,
3. testing of mechanical properties (compressive, tensile, flexible, shear strength, abrasion, hardness) and physical properties of building materials according to the newest National and European Standards.

Literature: Ashby M., Jones D.R.H.: Engineering Materials 1: An Introduction to Properties, Applications and Design, Elsevier, 2005;
Ashby M., Jones D.R.H.: Engineering Materials 2: An Introduction to Microstructures, Processing and Design, Elsevier, 2006;
Bull J.: Durability of Materials and Structures in Building and Civil Engineering, Whittles Publishing, 2006;
Jacobs J., Kilduff T.: Engineering Materials Technology. Structures, Processing, Properties and Selection, Prentice Hall Publishing, 2005;
Shackelford J.F.: Introduction to Materials Science for Engineers, Prentice Hall Publishing, 2004;
Timings R.L.: Engineering Materials, Vol.1, Longman, 1998;
Timings R.L.: Engineering Materials, Vol.2, Longman, 2000.

Course type: 15L + 15 Cl. + 30 Lab. (1^{th} semestr: 15L + 15 Cl., 2^{nd} semester: 30Lab.

Assessment method: Midterm, Final exam, Lab reports.

Primary target group: undergraduate students

Lecturer: Emilia Luchter-Marchewka, M.Sc.; Teresa Zych, Ph..D., Izabela Hager, Ph.D.

Contact persons: Emilia Luchter-Marchewka, M.Sc. ; Teresa Zych, Ph. D.
Phone: +48 12 628 21 55,
e-mail: tzych@imikb.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **BUILDING THERMAL PHYSICS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: Course covers the problems of energy and moisture transfer in building materials and components. The basic heat transfer phenomena, convection, radiation and conduction, are introduced to describe the heat losses through building shell and estimate its required insulation features. Building material humidity is described by means of moisture sorption, diffusion and capillary pull-up. Heat and moisture transport influence the building structure design especially in case of the multilayered walls and roofs. Non-stationary heat flow is connected with building thermal stability of the building shell. The thermal comfort concept and parameters that describe the conditions in building interior are discussed.
Laboratory: measurement of temperature, humidity, heat flow, thermal comfort, climatic chamber, 2D heat flow computer calculations.

Literature: Basic literature on building physics principles may be used

Course type: 20 L 5 Lab

Assessment method: Final test

Prerequisites: Physics and building engineering

Primary target group: 3rd year civil engineering and architecture

Lecturer: Tomasz Kisilewicz, Ph.D. Eng.

Contact person: Tomasz Kisilewicz, phone: (+48 12) 628 2397,
e-mail: tkisilew@pk.edu.pl

Deadline for application:

COURSE TITLE: **CHEMISTRY**

Institute/Division: Institute of Building Materials and Structures

Number of contact hours: 45

Curse duration: 1 semester

ECTS credits: 3

Course description: Lectures:Cohesion forces of homogeneous and heterogeneous materials. States of matter: characteristics of liquids, solids – crystalline and amorphous solids. Single-phase and multiphase dispersion systems. Characteristics of colloids – receiving, properties, durability. Division and application of emulsions. Macroscopic dispersion. Surface phenomena and their importance in building engineering. Characteristics and division of chemical reactions taking place in building engineering. Chemical kinetics and chemical equilibrium. Physical chemistry of water. Dissociation, electrolytes, hydrolysis, hydration. Chemistry of mineral building materials, especially setting materials. Chemistry of plastics and bituminous materials. Chemistry of metals. Basics of electrochemistry: electrolysis, cells. Processes of metal corrosion.
Laboratory classes: Chemical reactions and basic chemistry rules, properties of colloids, water analysis used for preparing concrete mix, corrosion of concrete and steel, characteristics of building binders and their properties, basic properties of polymers and their application in building industry.

Literature:

R. Chang: "General Chemistry", Random House, New York ,1986, A.M. Neville: "Properties of Concrete", 4th Edition,1996, "Lea's Chemistry of Cement and Concrete", 2nd Edition

Course type: 15 L + 30 Lab.

Assessment method: Lectures: Written exam.
Laboratory classes: Six tests concerning each individual topic.

Primary target group: 1st year students – undergraduate students

Lecturer: Aleksander Kozak, Ph.D. ; Tomasz Zdeb, Ph.D.

Contact persons: Aleksander Kozak, Ph.D. ; Tomasz Zdeb, Ph.D.
Phone: +48 12 628 23 69
e-mail: akozak@imikb.wil.pk.edu.pl
tzdeb@imikb.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **CLASSICAL MECHANICS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 105

Course duration: 2 semesters

ECTS credits: 10

Course description: Force systems, reduction of a system of forces, distributed forces, statics of systems of particles and rigid bodies, equilibrium conditions, reactions at supports for statically determined systems, friction, principle of virtual work, kinematics and kinetics of particles and rigid bodies, work and energy, moments of inertia, conservation laws, d'Alembert Principle, Lagrange equations, Hamilton's principle, oscillations, stability analysis, dynamics in non-inertial reference frames.

Literature:
Beer F.P., Johnston E.R., *Vector Mechanics for Engineers*, McGraw-Hill, 1997
Banach S., *Mechanics,* Warszawa 1951,
Meriam J.L., Kraige L.G., *Engineering Mechanics*, Vol. 1 Statics, Vol. II Dynamics, 1997
Timoshenko S., Young D.H., *Engineering Mechanics*, Mc Graw-Hill, 1956
Rao A. V., *Dynamics of Particles and Rigid Bodies : A Systematic Approach*, Cambridge 2006.

Course type: 60L + 45 P (1th semestr: 30L + 15 P, 2nd semester: 30L + 30 P)

Assesment method: Short tests, longer term projects, final oral and written exam,

Prerequisities: Calculus (differentiation, integration), vector analysis, ordinary differential equations.

Primary target group: Students undergraduate degree (BCs) in Civil Engineering:

Lecturer: Dorota Jasińska Ph.D., Marian Mikołajek Ph.D.

Contact person: Dorota Jasińska Ph.D.; phone: +48 12 628 23 41, jasinska@limba.wil.pk.edu.pl
Marian Mikołajek Ph.D.; phone +48 12 628 23 22, mikol@optra.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **CONCRETE STRUCTURES**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 120

Course duration: 2 semesters

ECTS credits: 5 + 5

Course description: The teaching process is focused on the introduction of the fundamentals of RC structures design including procedures of check of every design phase. Moreover, the presentation includes a wide information on the technology as well as on requirements of quality. Several workshop meetings on building sites complete the teaching course. In parallel, practical exercise is carried out which includes a complete design of a typical RC structures (slab, beam, column, foundation, retaining wall).

Text books: Bibliography referring to the design of RC structures
Ghali, R. Favre – Concrete structures – stresses and deformations, E&FN Spon

Course type: 60L + 60 P (1th semestr: 30L + 30 P, 2nd semester: 30L + 30 P)

Assessment method: Exam including verification of theoretical assumptions of design, selection of design steps and technological procedures earlier discussed (70%). Evaluation of the practical design carried out (30%).

Prerequisites: Mechanics, Structural mechanics, Strength of Materials, Concrete technology, Building materials

Primary target group: 3rd and 4th year students

Instructors: Piotr Gwoździewicz Ph.D.
Sylwia Schoenowitz-Żuradzka M.Sc.,

Contact person: Piotr Gwoździewicz Ph.D.

Deadline for application: June 30 or November 30

COURSE TITLE: **CONCRETE STRUCTURES 1**

Institute/Division: Institute of Building Materials and Structures
Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1st semester (Fall semester)

ECTS credits: 5

Course description: Basis for RC structures design – general requirements, design method, material properties (concrete, reinforcing steel), ULS (bending, shear).
Structural RC members (slabs, beams) – design, detailing and particular requirements.

Practical examples (design workshops) – static calculation and dimensioning of the typical RC elements (with drawings).

Text books:

1. EN1992-1-1: Eurocode 2: Design of concrete structures – Part 1: General rules and rules for buildings.
2. Structural Concrete – Textbook on Behaviour, Design and Performance. (FIB Bulletins 1,2,3) – vol.1, 2, 3.
3. J. MacGregor, J. Wight: Reinforced concrete – Mechanics and design. Prentice Hall, 2006.

Course type: 30L + 30 P

Assessment method: The final mark for the course contained two elements (both with the weight of 50%): written exam and completed design exercises.

Prerequisites: Mechanics, Structural Mechanics, Strength of Materials, Concrete Technology, Building Materials

Primary target group: 3rd and 4th year students

Instructors: Andrzej Winnicki, Ph.D., D.Sc.
Krzysztof Chudyba, Ph.D.

Contact person: Andrzej Winnicki, Ph.D., D.Sc.
e-mail: andrzej@dorabella.wil.pk.edu.pl

Deadline for application: November 30

COURSE TITLE: **CONCRETE STRUCTURES 2**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 2nd semester (Spring semester)

ECTS credits: 5

Course description: ULS (torsion, compression, tension) and SLS (deflection, crack control). Structural RC members (columns, foundations, frames) – design, detailing and particular requirements.
Practical examples (design workshops) – static calculation and dimensioning of the typical RC elements (with drawings).

Text books:

1. EN1992-1-1: Eurocode 2: Design of concrete structures – Part 1: General rules and rules for buildings.
2. Structural Concrete – Textbook on Behaviour, Design and Performance. (FIB Bulletins 1,2,3) – vol.1, 2, 3.
3. J. MacGregor, J. Wight: Reinforced concrete – Mechanics and design. Prentice Hall, 2006.

Course type: 30L + 30 P

Assessment method: The final mark for the course contained two elements (both with the weight of 50%): written exam and completed design exercises.

Prerequisites: Mechanics, Structural Mechanics, Strength of Materials, Concrete Technology, Building Materials

Primary target group: 3rd and 4th year students

Instructors: Andrzej Winnicki, Ph.D., D.Sc.
Krzysztof Chudyba, Ph.D.

Contact person: Andrzej Winnicki, Ph.D., D.Sc.
e-mail: andrzej@dorabella.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **CONCRETE TECHNOLOGY**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: This one-semester course is focused on technology of concrete, which is the most popular building material. The course is divided into three parts: lectures, classes and laboratories. Within the confines of lectures students learn about concrete ingredients (cement, aggregate, water, admixtures and additives) as well as concrete itself, their properties, test methods and standard requirements. Students are taught also about design methods (proper selection of type and amount of individual components taking into consideration designed concrete parameters); technology of concrete production and curing; and quality control. Within the confines of the practice part of the course students carry out some laboratory exercises and tests on cement, aggregate, paste, mortar and concrete. Moreover they make some concrete design: by experimental method as well as by computational one. The range and level of lectures, classes and laboratories may be tailored to students' advancement, needs and progress

Literature: Basic literature on concrete technology (e.g. Properties of concrete by A.M. Neville) and a few dozen European standards referred to concrete, its ingredients and various testing methods.

Course type: 15 L + 15 Cl. + 15 Lab.

Assessment method: Review and evaluation of completed exercises and design assignments. Testing subject knowledge orally and on paper.

Prerequisites: Lecture hall, Laboratory, basic knowledge on building materials

Primary target group: Undergraduate civil engineering students

Advanced target group: Civil engineering students after basic course of Concrete Technology

Lecturer: Lucyna Domagała, Ph.D.; Maciej Urban, Ph.D.

Contact person: Lucyna Domagała, phone: +48 12 628 23 63; e-mail: ldurych@imikb.wil.pk.edu.pl.

Deadline for application: June 30 or November 30

COURSE TITLE: **FOUNDATIONS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 5

Course description: Definitions, models and types of foundations. Limit states. Partial safety factors (Eurocode 7). Shallow foundations (including design). Deep foundations (especially pile foundations, including design). Excavations and protecting deep excavations. Dewatering of excavations.

Literature:

1. Atkinson J.H., Bransby P.L. (1978): The mechanics of soil. An introduction to critical state soil mechanics. McGHRAW-HILL
2. Head K.H. (1992): Manual of soil laboratory testing. Volume 1, Soil classification and compaction tests. Volume 2, Permeability, shear strength and compressibility tests. Volume 3, Effective stress tests. Second Edition. Halsted Press: an Imprint of JOHN WILEY & SONS, INC. New York – Toronto.

Course type: 30 L + 30 P

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Soil mechanics

Primary target group: Students of the third year of the study

Lecturer: Prof. Bogumił Wrana, Prof., Ph.D., D.Sc.

Contact person: Bogumił Wrana, Prof., Ph.D., D.Sc.

Deadline for application: June 30 or November 30

COURSE TITLE: **FRACTURE, FATIGUE AND DAMAGE MECHANICS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 90

Course duration: 1 semester

ECTS credits: 6

Course description: Fracture of cracked members, Griffith theory, stress concentration, stress intensity factor and material toughness.
Criteria for crack propagation, COD method, R-curves. Fatigue of materials – stress-based approach, fatigue crack growth.
Time-dependent behavior (creep and fatigue).
Basics of damage mechanics, application of damage mechanics to life-time evaluation of structural members

Literature:
1**.** N.E.Dowling, Mechanical Behavior of Materials. Engineering Methods for Deformation, Fracture, and Fatigue, Prentice-Hall, 1991,
2. Lemaitre, J. and Chaboche, J.-L., Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

Course type: 45 L + 45 P

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Mechanics of Materials, Theory of Elasticity and Viscoplasticity

Primary target group: Students of the second year of the study

Lecturer: Prof. Marcin Chrzanowski, Ph.D., D.Sc.
Prof. Janusz German, Ph.D., D.Sc.

Contact person: Prof. Marcin Chrzanowski, Ph.D., D.Sc. ;
e-mail: mc@limba.wil.pk.edu.pl

Deadline for application: June 30 or September 30

COURSE TITLE: **INTRODUCTION TO COMPUTATIONAL METHODS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits 3

Course description: The objective of the course is to explain basic concepts of approximate solution of engineering problems. The course contents is as follows. Mathematical modelling. Local and global formulation of boundary value problems. Variational methods and approximate solutions (Ritz method and weighted residuals). Fundamentals of finite element method (FEM). FEM modelling of bar and frame structures. Solution of two-dimensional elliptic problems of heat flow and continuum mechanics.

Text books: Zienkiewicz, O. C. and Taylor, R.L., *Finite Element Method*, Elsevier, 2000.
Cook, R.D., *Finite Element Method for Stress Analysis*, J. Wiley & Sons, 1995.

Ottosen, N. and Petersson, H., *Introduction to the Finite Element Method*, Prentice Hall, 1992.

Course type: 15 L +15 Lab.

Assessment method: Laboratory assignments and two tests taken in class

Prerequisites: Numerical methods, continuum mechanics

Primary target group: Undergraduate students of engineering

Lecturer: Prof. Jerzy Pamin, Ph.D., D.Sc., Prof. Witold Cecot Ph.D., D.Sc.

Contact person: Jerzy Pamin, phone: +(48 12) 628 25 48;
e-mail: jpamin@L5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **INTRODUCTION TO MANAGEMENT TECHNIQUES APPLIED TO CONSTRUCTION PROJECTS**

Institute/Division: Section of Building Technology and Organization

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: This is one semester course dedicated for Civil Engineers interested in problems of management in construction. It is aimed to help Engineers to understand and learn basics form the field of management in construction. It introduces several costing, planning and controlling techniques useful in Engineer's professional career. During lecture phase of this course, participants will acquire general knowledge of chosen management techniques applied to construction projects. Participants will learn how to use presented techniques during the projects life cycle. During laboratory classes of this course, participants will solve problems from the field of management in construction using learnt techniques and computer programmes. Type of laboratory tasks and scope of problems may be linked to participants specialization or interest.

Literature: Basic literature on construction management and project management for construction. For example: Hendrickson C., Tung A.: Project Management for Construction, Prentice Hall, International Series 1989, Oxley R., Poskitt J.: Management techniques applied to the construction industry, BSP Professional Books, Oxford 1992

Course type: 15 L + 15 Lab.

Assessment method: Attendance to lectures and laboratories, evaluation of exercises and tasks.

Prerequisites: General knowledge of management techniques applied in construction projects. Basic skills in computer aided costing, planning and controlling of construction projects.

Primary target group: 4th year Civil Engineering

Lecturer: Michał Juszczyk, Ph.D.

Contact person: Michał Juszczyk, Ph.D, phone +48 12 628 23 54;
e-mail: mjuszczyk@izwbit.pk.edu.pl

Deadline for application: June 30th

COURSE TITLE: **LOW ENERGY BUILDING DESIGN**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: Course covers all the aspects of energy saving measures that should be taken to reduce building energy demand like: building lot shape and orientation, building location and orientation, thermal zoning, window features and distribution, thermal mass, passive solar use, thermal bridges, heat recovery etc. Students have a possibility to learn that thinking about energy must be present at the all designing stages, in general concept and in the tiny detail of the building. Standard of European passive house, but also dynamic aspects of energy conservation and storage are presented and discussed. Computer programs, supporting designing process are introduced to enhance the quality of design.

Literature: E. Mazria, 1978. The Passive Solar Energy Book, Rodale Press Emaus;
A.K. Athienitis, M.Santamouris, 2002. Thermal Analysis and Design of Passive Solar Buildings, James & James;

Course type: 30 L

Assessment method: Final test

Prerequisites: Building Physics

Primary target group: 3rd year civil engineering or architecture

Lecturer: Tomasz Kisilewicz, Ph.D., D.Sc.

Contact person: Tomasz Kisilewicz, phone: +48 12 628 23 97,
e-mail: tkisilew@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **MATLAB IN PROGRAMMING, VISUALIZATION AND NUMERICAL SIMULATIONS**

Institute / Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: The Matlab package constitutes a powerful engineering tool which is commonly applied in practical analysis of variety of various engineering problems. This course is oriented on learning Matlab, starting from its fundamentals. The impact is laid upon

- matrix and vector variables as the basic numerical data format in Matlab as well as the operations on them,
- application of the most common built-in functions,
- 2D and 3D graphics,
- structural programming (functions, loops, conditions),
- development of the graphical user interface,
- implementation of the most important numerical techniques, e.g. for approximation, numerical differentation and integration, solving the non-linear problems as well as numerical analysis of the initial and boundary value problems.

Students will be encouraged to implement presented algorithms on their own, individually or while working in small groups.

Text books: David Houcque, “Introduction to Matlab for engineering students”, Northwestern University, 2005.
Press, WH; Teukolsky, SA; Vetterling, WT; Flannery, BP, “Numerical Recipes: The Art of Scientific Computing (3rd ed.)”, New York: Cambridge University Press, 2007

Course type: 30 Lab.

Assessment method: Laboratory assignments

Prerequisities: Numerical methods, Informatics

Primary target groups: Students of engineering (undergraduate)

Lecturer: Sławomir Milewski, PhD

Contact person: Sławomir Milewski, phone (+48 12) 628 2563\
e-mail: slawek@L5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **MECHANICS OF MATERIALS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 180

Course duration: 2 semesters

ECTS credits: 5+5

Course description: Introduction to mechanics of materials. Internal forces: method of sections, definition of internal forces, equivalence of the systems of internal and external forces, functions of resultant internal forces in a bar member – axial force, shear forces, twisting moment, bending moments, relation between distributed load, shear force and bending moment.Basic elasticity: stress, state of stress, principal stresses, equations of equilibrium and static boundary conditions; deformations and strains, compatibility of strains; constitutive equation of linear elasticity (Hooke's law). Elastic potential. Boundary-value problem of linear elasticity – examples of solutions for a prismatic bar: free torsion, tension, pure and simple bending, combined bending-tension and bending–shear problems.Strength and toughness of materials: material effort, strength hypotheses, energy-based criteria of elastic limit states – Huber-Mises-Hencky criterion. Basic concepts of fracture mechanics, strength, fracture and toughness in engineering materials.Buckling of columns: Euler buckling load, effective length, eccentric loads and secant formula. Basics of thin-walled rods theory. Introduction to fatigue and creep of materials and structures. Basics of composite materials.

Literature: 1. N.E.Dowling, Mechanical Behavior of Materials. Engineering

	Methods for Deformation, Fracture, and Fatigue, Prentice-Hall,1991, 2. Lemaitre, J. and Chaboche, J.-L., Mechanics of Solid Materials,Cambridge University Press, Cambridge, 1990. 3. J.M. Gere, Mechanics of Materials, Brooks/Cole Thompson Learning,5th edition, 2001
Course type:	75 L + 75 P + 30 Lab. (1th semestr 45 L + 30 P, 2nd semestr: 30 L + 45 P + 30 Lab.)
Assessment method:	Individual evaluation, computer tests
Prerequisites:	Mathematics, Theoretical Mechanics
Primary target group:	Students of the second year of the study
Lecturer:	Prof. Marcin Chrzanowski, Ph.D., D.Sc., Małgorzata Janus-Michalska Ph.D., Adam Zaborski Ph.D.
Contact person:	Prof. Marcin Chrzanowski Ph.D., D.Sc., e-mail: mc@limba.wil.pk.edu.pl
Deadline for application:	June 30 or September 30

COURSE TITLE:	**NUMERICAL METHOD**
Institute/Division:	Institute for Computational Civil Engineering
Erasmus subject code:	06.4
Number of contact hours:	60
Course duration:	1 semester
ECTS credits:	5
Course description:	The objective of the course is to explain basic concepts of solution approximation for selected, typical in engineering practice, mathematical problems. The course outline is as follows: mathematical modeling, Gauss elimination, solution of algebraic eigenvalue problems, root finding, approximation of functions, numerical differentiation and integration, local and global formulation of boundary value problems, finite difference method, Galerkin approach, integration of initial problems, basis of optimization and

	statistics, error, convergence, stability and conditioning of numerical methods. Besides understanding of the presented methods students are expected to code them in Matlab language as well as utilize Matlab functions to solve problems at hand.
Literature:	W. H. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes: The Art of Scientific Computing, Cambridge University Press, 2007 (or earlier editions). M.Schatzman, Numerical Analysis: A Mathematical Introduction, Clarendon Press, Oxford 2002.
Course type:	Lectures and lab sessions
Assessment method:	Laboratory assignments and two written tests given in Class
Prerequisites:	Algebra, basis of programming
Primary target group:	Undegraduate students of engineering
Lecturer:	Witold Cecot, Marta Serafin
Contact person:	Witold Cecot, plcecot@cyf-kr.edu.pl
Deadline for application:	June 30 or November 30

COURSE TITLE:	**PRECAST CONCRETE STRUCTURES**
Institute/Division:	Institute of Building Materials and Structures
Erasmus subject code:	06.4
Number of contact hours:	30
Course duration:	1 semester
ECTS credits:	5

Course description: The teaching process is focused on the introduction of the fundamentals of technology and design of precast concrete structures including especially procedures of check of every work phase. Several details specific for precast structures are widely discussed together with their evaluation methods. Practical exercises carried out in parallel includes a selected part of a design of a typical precast concrete structure.
The teaching process is focused on the introduction of the fundamentals of PC structures design including procedures of check of every design phase. Moreover, the presentation includes a wide information on the technology as well as on requirements of quality. Several workshop meetings on building sites complete the teaching course. In parallel, practical exercise is carried out which includes a complete design of a typical PC structure (slab, girder).

Literature: K. S. Elliot, Multi-Storey Precast Concrete Framed Structures
A. Ghali, R. Favre – Concrete structures – stresses and deformations, E&FN Spon
A. Naaman – Prestressed concrete analysis and design, Techno Press 3000 Ann Arbor, MI
E. G. Nawy – Prestressed concrete – a fundamental approach, Prentice Hall Intl.

Course type: 15L + 15 P

Assessment method: Final exam including verification of theoretical assumptions of design for a selected element specific for this type of structures.

Prerequisites: Mechanics, Structural mechanics, Strength of Materials, Concrete technology, Building materials

Primary target group: 1st year students – undergraduate students

Lecturer: Wit Derkowski, Ph.D, Sylwia Schoenowitz –Żuradzka, M.Sc.

Contact person: Wit Derkowski, Ph.D; e-mail: derkowski@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **RAILWAY INFRASTRUCTURE**

Institute/Division: Institute of Road and Railway Engineering

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: Railway in the whole transportation system. Basic elements of railway infrastructure: track and its foundation, bridges, tunnels, turnouts and crossing. Basic information on power system, control and traffic management system. Design of railway lines, track gradients, curvilinear track sections (cant, cant deficiency, transition curves). Basic information on rail vehicles, multimodal traction units. Railway station and its elements. High speed and conventional railway infrastructure. Recent concepts for railway systems and railway infrastructure

Literature: Esveld C., Modern Railway Track, MRT production, Utrecht, ISBN 90-800324-1-7, 2001; Technical Specification for Interoperability, Infrastructure – Conventional Railway and High Speed European Network (European Commission – Energy and Transport official www pages); European Standards

Course type: 15 L + 30 S

Assessment method: exercises and exam

Prerequisites: basic knowledge on transportation engineering

Primary target group: MSc (Civil Transportation Engineering)

Lecturer: Prof. Włodzimierz Czyczuła, Ph.D., D.Sc.
Juliusz Sołkowski Ph.D.

Contact person: czyczula@pk.edu.pl or solkow@transys.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **ROAD DESIGN**

Institute/Division: Institute of Road and Railway Engineering

Erasmus subject code: 06.4

Number of contact hours: 60 hours

Course duration: 1 semester

ECTS credits: 5

Course description: Historical development of roads. Road function (system of classification; functional relationships and categories). Design controls and criteria (design vehicles; driving behaviour models, speed and design; traffic characteristic; factor other than traffic volume, micro - simulation models). Elements of deign (geometric of sight distance; horizontal alignment; determination of design radius; superelevation; transition and compound curves; vertical alignment; vertical curves; alignment coordination in design). Cross section elements (lane widths, shoulders; curbs, sidewalks; drainage channels and sideslopes, traffic barriers). Earthworks operations (embankment and excavation; computing earthworks quantities; mass diagram). Design of drainage and facilities (hydrologic approaches and concepts; open channels, culverts, hydraulic design). Project evaluation. Exercise: geometrical alignment for given section of road.

Literature Highway Design Handbook", U.S. Department of Transportation Federal Highway Administration, 2001
"Transportation and traffic engineering Handbook", Institute of Transportation Engineers, Washington 1989
Traffic and Highway Engineering", Garber N., Hoel L., Pacific Grove 2001**:**

Course type: 30 L + 30 Cl.

Assessment method: Evaluation of prepared design for road section. Examination

Prerequisites: Not required

Primary target group: Road Engineering

Lecturer: Andrzej Szarata Ph.D.

Contact person: Andrzej Szarata Ph.D.,
e-mail: aszarata@transys,wil.pk.edu.pl
phone: + 48 12 628 25 33

Deadline for application: June 30 or November 30

COURSE TITLE: **“ROBOT” COMPUTER CODE**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: Application of the Finite Element Method to solve engineering problems, especially oriented on needs of practicing Civil Engineer, using an integrated design environment (“ROBOT”). The student will be step by step acquainted with approach to computer modeling of several engineering structures, i.e. the definition of:
geometry (shape and boundary conditions) including the import of geometry description from geometry modeling software, and automatic subdivision of analyzed structure into finite elements,loads (permanent and variable loads according to engineering code) including automatic generation of wind and snow loads,load combinations;solution of a boundary problem using Finite Element Method, in case of linear or nonlinear statics, dynamics or stability, as implemented in the code, and postprocessing:dimensioning of structural members and their connections,presentation of results using text and graphical interface of “ROBOT”,documenting the project for verification and further reference.

Course type: 30 Lab.

Assessment method: Evaluation of the submitted design.

Prerequisites:	Strength of materials, Structural mechanics, Fundamentals of Finite Element Method.
Primary target group:	Students of Civil Engineering
Lecturer:	Michał Pazdanowski, Ph.D.
Contact person:	Michał Pazdanowski, phone: +48 12 628 29 29; e-mail: plpazdan@cyf-kr.edu.pl
Deadline for application:	June 30 or November 30

COURSE TITLE: **SOIL MECHANICS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 5

Course description: Soil and Rock identification. Soil classification (including geotechnical categories). Nature, physical and mechanical properties of soil. Ground water – appearance and phenomenon connected with it. Properties of dry and saturated soil. Laboratory and in-situ tests. Basic soil models. Bearing capacity of soils and foundations. Allowable pressure. Limit states. Stress distribution in the subsoil (total and effective stresses). Theory of consolidation and rheology of soil. Soil settlements. Slope stability.

Literature: Atkinson J.H., Bransby P.L. (1978): The mechanics of soil. An introduction to critical state soil mechanics. McGHRAW-HILL
2. Head K.H. (1992): Manual of soil laboratory testing. Volume 1, Soil classification and compaction tests. Volume 2, Permeability, shear strength and compressibility tests. Volume 3, Effective stress tests. Second Edition. Halsted Press: an Imprint of JOHN WILEY & SONS, INC. New York – Toronto.

Course type: 30 L + 30 Lab

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Mechanics of materials

Primary target group: Students of the second year of the study

Lecturer: Prof. Bogumił Wrana, Ph.D., D.Sc.

Contact person: Prof. Bogumił Wrana, PhD, DSc.,
e-mail: wrana@limba.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **STRUCTURAL MECHANICS**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60 + 60

Course duration: 2 semesters

ECTS credits: 6 + 6

Course description:

Lecture:

Semester I: Assumptions, definitions and terms in structural mechanics. Influence lines of static values in statically determinate structures. Calculation of displacements in statically determinate structures. Force (Flexibility) Method – analysis of statically indeterminate structures. Displacement (Stiffness) Method– analysis of statically indeterminate bar structures.

Semester II: Instability of bar structures – determination of critical load. Dynamic degrees of freedom. Dynamic calculation models – single and multi-degree of freedom models. Free vibrations of bar structures. Damping parameters. Dynamic coefficient.

Class exercise:

Semester I: Examples of determination of influence lines in statically determinate structures. Determination of displacements in such structures. Examples of solutions of statically indeterminate structures using Force (Flexibility) Method (beams, frames, arches, trusses). Examples of solutions of statically indeterminate structures using Displacement (Stiffness) Method.

Semester II: Determination of critical loads in bar structures. Determination of equivalent lengths in compressed members and determination of buckling modes. Determination of free vibrations of single and multi-degree of freedom bar structures (free vibration frequencies, free vibration forms). Determination and application of dynamic coefficients.

Design exercises:

Semester I: Determination of influence lines of assigned static values in statically determinate beam, frame and truss. Determination of assigned displacements in statically determinate beam, frame and truss. Solution of statically indeterminate continuous beam, frame and truss using Force (Flexibility) Method.

Semester II: Solution of statically indeterminate continuous beam and frame using displacement (Stiffens)

Method. Determination of basic critical load in a bar structure and its buckling mode. Determination of free vibration frequencies and free vibration forms in a multi-degree of freedom bar structure.

Literature: Structural and stress analysis" - Dr. T. H. G. MEGSON, Butterworth-Heinemann, Linacre House, Jordan Hill, Oxford *OX2* 8DP, First published in Great Britain by Arnold 1996
"Civil engineer's reference book" – L. S. Blake, Butterwo rth-Heinemann, Linacre House, Jordan Hill, Oxford OX2 8DP, 1989

Course type: 30 L + 30 C + 60 D (semester I: 15 L + 15 C + 30 D, semester II: 15 L + 15 C + 30 D)

Assessment method: **Semester I:** Elaboration and crediting design exercises (number 1 – influence lines and displacements in statically determinate structures, number 2 – Force (Flexibility) Method)., crediting tests
Semester II: Elaboration and crediting design exercises (number 3 – Displacement (Stiffness) Method, number 4 – free vibrations and dynamic coefficient), crediting tests, crediting tests

Prerequisites: Good understanding of statically determinate structures (flat beams, frames and trusses) is vital.

Primary target group: 3rd or 4th year of Civil Engineering

Lecturer: Dr eng. Ryszard Masłowski.

Contact person: Dr eng. Ryszard Masłowski, phone +48 12 628 23 38; e-mail: rmaslows@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **TECHNICAL DRAWING AND COMPUTER GRAPHICS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: Basic concepts of computer aided activities (CAx). Computer graphics – basic ideas, vector and raster graphics. Vector file formats. Graphic modellers (ACIS and Parasolid). Internal organization of a CAD program. Coordinate systems. Two dimensional drawing primitives and operations on such primitives. Text, dimensioning, blocks, hatching. Introduction to spatial modeling. Solids. Solid creation and solid representation. Boolean algebra and solid operations using such algebra. Projections. Projection techniques used with solid modeling. Surfaces and their mathematical descriptions used in computer graphics. L'Hermite, Bezier and B-spline based surfaces. Parametrical surfaces. Visualization: objectives, assumptions and methods. Solid presentation methods, wire frame models, flat, Gouraud and Phong shading, rendering. Raster file formats, colors, color perception and color modeling (RGB, CMYK, HSV). Color palette interpolation and applications of color modeling. The basics of rendering methods. Rendering algorithms. Texturing.

Reading: AutoCAD manual.

Course type: 15 L + 30 Lab.

Assessment method: Evaluation of drawings created ac computer laboratory

Prerequisites:

Primary target group: Freshmen

Lecturer: Michał Pazdanowski, Ph.D.,

Contact person: Michał Pazdanowski, Ph.D., phone: (+4812) 628 29 29, e-mail: plpazdan@cyf-kr.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **THEORY OF ELASTICITY**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits 4

Course description: Models of deformable bodies (elasticity, plasticity, rheology), Lagrange and Euler descriptions of motion, measures of deformation and stress, kinematics equations, constitutive equations, Lame and Bertrami-Michel equations, plane state of strain and stress, disks and plates, Airy stress function, Lagrange and Castigliano variational principles, approximate methods (Rayleigh-Ritz, finite difference, finite elements).

Literature :

- Fung Y.C., *Foundations of Solid Mechanics*, Prentice-Hall, 1965
- Eringen A.C., *Nonlinear Theory of Continuous Media*, McGraw-Hill 1962,
- Leipholz H., *Theory of Elasticity*, Noordhoff, 1974

Course type: 30 L + 15 P

Assesement method: short tests, longer term projects, final written and oral exam

Prerequisities: classical mechanics, vector and tensor analysis, ordinary and partial differential equations

Primary target group: students graduate degree in Civil Engineering:

Lecturer Marian Mikołajek Ph.D.

Contact person: Marian Mikołajek Ph.D.
phone: +48 12 628 23 22,
e-mail: Mikol@optra.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **TRANSPORTATION PLANNING**

Institute/Division: Institute of Road and Railway Engineering

Erasmus subject code: 06.4

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 5

Course description: Classification of transport system; aspects of transportation; place of transport system in urban form; kinds of plans for development. Content of transportation study. Analysis of existing state, precondition for transport system development. Motorization hypothesis.
Classical procedure with four steps (stadiums) for travel model: travel generation, travel distribution, modal split, traffic assignment among transport networks. Rules for street network development in the scale of the whole town. Transportation planning in residential district. Patterns of street networks in housing estate and criteria of assessment. Exercise: preparing of transportation study for middle size town (selected issues, including traffic macro-simulation in street network).

Literature: "Transportation and traffic engineering Handbook", Institute of Transportation Engineers, Washington 1989
Transportation systems engineering: theory and methods", Cascetta E., Kluver – Dordrecht, 2001

Course type: 15 L + 30 P

Assessment method: Evaluation of prepared transportation study. Examination

Prerequisites: Not required

Primary target group: Road Engineering. Transportation Engineering,

Lecturer: Andrzej Szarata, Ph.D.

Contact person: Andrzej Szarata, e-mail: aszarata@pk.edu.pl,
phone: + 48 12 628 25 33

Deadline for application: June 30 or November 30

COURSE TITLE: **ADVANCED COMPUTER GRAPHICS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 6

Course description: The aim of this one semester course is a presentation of the selected aspects of advanced computer graphics techniques and tools. In particular this course concentrates on the techniques for visualization of the three-dimensional scientific data sets. The course starts with the recapitulation of the basic facts regarding raster and vector graphics. Then it recalls the description of the 3D geometric transformations including viewing transformations. This is followed by the overview of the role and the techniques for building the visualization pipeline. The three subsequent presentations discuss a description of various objects used in computer graphics including: representation of solids, grids and representation of scientific data sets, NURBS representation of curves and surfaces. On the practical side this course presents advanced visualization tools based on the VTK (The Visualization Toolkit) C++ library. The course explains the principles of programming with VTK and presents certain visualization techniques for the scientific data sets based on unstructured grids. Finally a short introduction to the photo-realistic visualization and Blender program is given. Following the tutorial part, the students will work on individual visualization projects using the VTK library. The project part of this course requires programming skills. After this course the students will understand the architectural principles of modern visualization software, will understand the role of data structures in representing various geometric objects, in particular the unstructured grids. They will be able to create, compile and run VTK programs and to program several basic visualization algorithms.

Literature: Foley, van Dam, Feiner, Hughes, "*Computer Graphics. Principles and Practice*",
Schroeder, Martin, Lorensen, "*The Visualization Toolkit. An Object-Oriented Approach to 3D Graphics*

Course type: 30 L+15 Lab. + 15 P

Assessment method: Evaluation of the final project submission

Prerequisites: Algorithms and Data Structures, Object-Oriented Programming

Primary target group:

Lecturer: Roman Putanowicz, Ph.D.

Contact person: Roman Putanowicz; e-mail: putanowr@l5.pk.edu.pl
Deadline for application: June 30 or November 30

COURSE TITLE: **ADVANCED SOIL MECHANICS AND GEOTECHNICAL ENGINEERING**

Institute/Division: Institute of Structural Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 4

Course description: Special Foundations - Diaphragm walls. Retaining structures. Structures of reinforced soil. Ground Improvement Techniques - Surface strengthening (mechanically stabilization, binder sealing), soil replacement, static and dynamic compaction, vibro systems (vibro-compaction, vibroreplacement), dynamic replacement, micropiles, jet grouting method, deep mixing; vertical wick drains, lightweight fill materials, geotextiles, slope stability: anchoring, nailing. Geotechnical problems in environmental protection. Seismic and para-seismic influences on soil behavior. Soil-Structure interaction. Numerical soil models.

Literature:

1. Atkinson J.H., Bransby P.L. (1978): The mechanics of soil. An introduction to critical state soil mechanics. McGHRAW-HILL
2. Head K.H. (1992): Manual of soil laboratory testing. Volume 1, Soil classification and compaction tests. Volume 2, Permeability, shear strength and

compressibility tests. Volume 3, Effective stress tests. Second Edition. Halsted Press: an Imprint of JOHN WILEY & SONS, INC. New York – Toronto.

Course type: 30 L + 30 P

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Soil mechanics

Primary target group: Students of the third year of the study

Lecturer: Prof. Bogumił Wrana, Ph.D., D.Sc.

Contact person: Prof. Bogumił Wrana, Ph.D., D.Sc.,
e-mail: wrana@limba.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **ADVANCED STRUCTURAL MATERIALS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 2

Course description: **Lectures:** Types of engineering materials: metals and alloys, ceramics and glasses, polymers, composite materials. Relation and interaction between the manufacturing process, structure and properties. Crystal structure of metals. Structural steels: Fe-C system, structural steel components, examples of steel products, influence of alloys elements on the properties of steel. The role of heat treatment in steel production. The properties and characteristic features of high performance cementitious materials (HPC and RPC). Properties and application of concretes with special aggregates type (LWC, HWC). Composite materials with mineral and organic matrices. Reinforcement mechanisms in composite materials. Nanomaterials: examples from nature, classification, characteristics, properties. Special application of nanotechnology in construction.

Laboratory: Determination of modulus of elasticity and Poisson's ratio of brittle materials. Mechanical properties modification of steel by heat treatment. The role of admixtures in new generation cement concretes (SCC). Properties and application of concretes with special aggregates type (LWAHPC). Toughness index determination of brittle materials modified with fibrous inclusion (RPC, FRC). The basics of structural and microstructural materials testing. Advanced techniques of mechanical and physical properties determination of construction materials.

Literature:

1] Budinski K.G., Budinski M.K, Engineering Materials Properties and selection, 9 ed. Pearson, 2010
[2] Ashby M.F. Jones D.R.H. Engineering materials 2: An introduction to Microstructure, Processing and Design, Elsevier, 2006
[3] Sicakova A., Śliwinski J., Hager I., Tracz T., Zdeb T., Zych T., Hela R., Bodnarova L. — New Generation Cement Concrete - Ideas, Design, Technology. - Ideas, Design, Technology and Applications, Kosice, 2008, TU Kosice
[4] Dobrzański L ., Podstawy nauki o materiałach i metaloznawstwo, Warszawa, 2002, WNT

Course type: 15 L + 15 Lab.

Assessment method: Final test, Laboratory reports.

Prerequisites: Course credits: Building Materials, Building Chemistry, Concrete Technology

Primary target group: Graduate students

Lecturer: Izabela Hager, Ph.D.

Contact person: Izabela Hager, Ph.D. (ihager@.pk.edu.pl, tel: 23-71)

Deadline for application: June 30 or November 30

COURSE TITLE: **APPLICATIONS OF ARTIFICIAL NEURAL NETWORKS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: This introductory course on artificial neural networks applications will give an overview of basic concepts, techniques, and algorithms in neural networks, beginning with topics such as a linear regression, least-square estimation and ending up with more recent topics such as Bayesian neural networks and Gaussian processes. The course will give the student the basic ideas and intuition behind modern neural networks models and applications in civil engineering as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is statistical inference as it provides the foundation for most of the methods covered.

Reading: C. Bishop, "*Neural networks for pattern recognition*", 1995

Course type: 15 L + 15 Lab.

Assessment method: problem sets evaluation

Prerequisites: calculus, linear algebra, statistics

Primary target group: 3rd, 4th year Civil Engineering students

Lecturer: Marek Słoński, Ph.D.

Contact person: Marek Słoński, Ph.D., phone +48 12 628 25 49;
e-mail: mslonski@l5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE:	**APPLICATIONS OF MATLAB IN SCIENCE AND ENGINEERING**
Institute/Division:	Institute for Computational Civil Engineering
Erasmus subject code:	06.4
Number of contact hours:	15
Course duration:	1 semester
ECTS credits:	1
Course description:	The objective of the course is to provide students with a knowledge of certain, useful for engineers, applications of MATLAB environment to numerical modeling. The course is focused on: symbolic operations, including linear algebra, algebraic and differential equations, integration; graphics and visualization in 2D and 3D; a plane stress and a plane strain problems; PDE toolbox; dynamic analysis of selected structures; basis of statistics; animation possibilities.
Text books:	B. R. Hunt, R. L. Lipsman, J. M. Rosenberg: A Guide to MATLAB: For Beginners and Experienced Users, Cambridge University Press, 2001. A. Quarteroni, F. Saleri: Scientific Computing with MATLAB and Octave, Springer, 2006.
Course type:	Lab sessions
Assessment method:	Laboratory assignments and own presentation
Prerequisites:	Matlab fundamentals
Primary target group:	Undergraduate and graduate students of engineering
Instructors:	Marta Serafin, Witold Cecot
Contact person:	Marta Serafin, mserafin@L5.pk.edu.pl
Deadline for application:	June 30 or November 30

COURSE TITLE: **BASIC COURSE IN COMPUTATIONAL MECHANICS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: The aim of the course is to present the mathematical foundations, algorithms and selected applications of discretization methods. In particular, different aspects of finite element (FE) modelling are covered. Finite elements for one-, two- and three-dimensional applications are discussed. Fundamental stationary and time dependent problems of mechanics are formulated. Eigenproblems of structural stability and free vibrations are derived. Sources of nonlinearity in mathematical models and FE algorithms for nonlinear problems are discussed. Concepts of alternative discretization methods (finite difference method, boundary element method, meshless methods) are reviewed**.**

Text books:
- O. C. Zienkiewicz; R.L.Taylor, *Finite Element Metho*", Elsevier 2000.
- Cook, R.D., *Finite Element Method for Stress Analysis*, J. Wiley & Sons, 1995.
- Ottosen, N. and Petersson, H., *Introduction to the Finite Element Method*, Prentice Hall, 1992.

Course type: 15 L + 15 Lab.

Assessment method: Individual exercises of FEM computations, examination test

Prerequisites: Passed courses: strength of materials, structural mechanics, fundamentals of FEM

Primary target group: Postgraduate students of engineering

Lecturer: Prof. Jerzy Pamin, Ph.D., D.Sc.**,** Prof. Witold Cecot, Ph.D., D.Sc.

Contact person: Jerzy Pamin, phone: +48 12)628 25 48;
e-mail: jpamin@L5.pk.edu.pl

Deadline for application: June 30 or November 3

COURSE TITLE: **COMPOSITE STRUCTURES – BRIDGES**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description:

Lecture: Basic definition and terminology. Rules of construction of composite structures. Calculation of geometric characteristics of composite section. Design of shear connector. Methods of calculation of composite structures load capacity. Building technology of composite structure. Influence of assembly condition, thermal loading, creep and shrinkage on stresses and strain in composite structures. Deflection of composite structures. Scratch of concrete slab in composite structures. Examples of composite structures – bridges and others.

Design exercises: Project of road composite beam bridge (conceptional drawings of the bride, static and load capacity calculation of the bridge – strength of main girder, deck slab, shear connector).

Lecture: Basic definition and terminology. Rules of con struction of composite structures. Calculation of geometric characteristics of composite section. Design of shear connector. Methods of calculation of composite structures load capacity. Building technology of composite structure. Influence of assembly condition, thermal loading, creep and shrinkage on stresses and strain in composite structures. Deflection of composite structures. Scratch of concrete slab in composite structures. Examples of composite structures – bridges and others.

Design exercises: Project of road composite beam bridge (conceptional drawings of the bride, static and load capacity calculation of the bridge – strength of main girder, deck slab, shear connector).

Literature:

1. Furtak K.: Mosty zespolone, PWN, 1999 r.
2. Furtak K.: Podstawy mostów zespolonych. Podręcznik akademicki. Politechnika Krakowska, 1999 r

Course type: 30 L + 15 P

Assessment method: Lecture and exercises attendance, execute of design exercise, final written examination.

Prerequisites:

Primary target group: Second cycle programme

Lecturer: Wojciech Średniawa, Ph.D., tel. 628 26-84, email: wsrednia@pk.edu.pl

Contact person: Wojciech Średniawa, Ph.D., tel. 628 26-84, email: wsrednia@pk.edu.pl

Deadline for application:

COURSE TITLE: **COMPUTATIONAL INTELLIGENCE**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: This introductory course on computational intelligence will give an overview of basic concepts, techniques, and algorithms from artificial neural networks, machine learning, fuzzy systems and evolutionary computing. We will begin with topics such as a linear regression, least-square estimation, simple genetic algorithm and ending up with more recent topics such as kernel methods and probabilistic graphical models. The course will give the student the basic ideas and intuition behind modern computational intelligence models and applications in civil engineering as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is statistical inference as it provides the foundation for most of the methods covered**.**

Reading: C. Bishop, "*Machine learning for pattern recognition*", 2006,
J-S. Jang et al., "*Neuro-fuzzy and soft computing*", 1997

Course type: 15 L + 15 Lab.

Assessment method: problem sets evaluation

Prerequisites: calculus, linear algebra, statistics

Primary target group: 3rd, 4th year Civil Engineering students

Lecturer: Marek Słoński, Ph.D.

Contact person: Marek Słoński, Ph.D., phone +48 12 628 25 49;
e-mail: mslonski@l5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **COMPUTATIONAL PLASTICITY AND DAMAGE MODELS WITH APPLICATIONS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: The course presents theoretical and computational issues listed below.
Concepts of plastic flow and damage of materials.
Thermodynamic foundations of constitutive models.
Yield functions and hardening hypotheses.
Damage measures and growth functions.
Loading/unloading conditions.
Combinations of plasticity and damage.
Computational implementation of plasticity and damage models.
Consistent linearization of equations.
Material softening and its consequences.

Applications in the simulation of deformation and failure of metals, (reinforced) concrete and soil.

Reading: Simo, J.C. and Hughes, T.J.R., *Computational Inelasticity*. Interdisciplinary Applied Mathematics Vol. 7, Springer-Verlag, New York, 1998.
Jirasek, M. and Bazant, Z.P., *Inelastic Analysis of Structures*, J. Wiley & Sons, Chichester, 2002
de Borst, R. and Sluys, L.J., *Computational Methods in Non-linear Solid Mechanics*, Lecture Notes, Delft University of Technology, Delft 1999.

Course type: 15 L + 15 Lab.

Assessment method: Individual project of FEM simulation of material inelasticity, examination test

Prerequisites: Passed courses: strength of materials, structural mechanics, fundamentals of FEM, computational mechanics

Primary target group: postgraduates students of engineering

Lecturer: Prof. Jerzy Pamin, Ph.D., D.Sc.

Contact person: Jerzy Pamin, phone: +48 12 628 25 48;
e-mail: jpamin@L5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **DESIGN OF FOOTBRIDGES**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 2

Course description: **Lecture:** Footbridge design guidelines (construction, using condision, geometry, aesthete). Present codes and guidelines review (PN, Eurocode, BS, ISO, others). Static

loads on footbridges. Current design practice (tendencies) for footbridges, examples of structures. Dynamics of structures – basic, general informations. Footbridges – flexible structures – examples and characteristics of structures, dynamics of footbridges, dynamical properties of footbridges – mass, stiffness, damping. Dynamic loads – human-induced excitation – walking, runing, jumping (vandal loading), pacing frequencies. Dynamic response analysis based on type of activity. Vibration acceptance criteria. Methods for vibration control and reduction (frequency tuning, vibration absorbers, special measures).
Design exercises: Static and dynamic analysis of exemplary beam footbridge under walking, running or jumping people excitation. Calculation of dynamic characteristics of the footbridge: natural frequencies, mode shapes, determinating the damping of the footbridge based on literature or research. Numerical calculation (FEM) of the dynamic response of the footbridge under moving load – walking, running or jumping people. Conclusions.

Literature:

1. *fib* Bulletin No. 32 "Guidelines for the design of footbridges", 2005.
2. Christa van den Berg, Gerhard Nijenhuis "Bridging the Dutch landscape – desig guidde for footbridges" Delft and BIS Publisher, Amsterda, 2006.
3. Elsa Caetano, et al., "Footbridge Vibration Design", 2009.
4. T. Chmielewski, Z. Zembaty "Podstawy dynamiki budowli", Arkady, 1998.
5. Footbridges. Assessment of vibrational behaviour of footbridges under pedestrian loading – technical giude", Sétra, 2006.
6. Ursula Baus, Mike Schlaich, Wilfried Dechau "Footbridges: construction, design, history", Birkhäuser, 2008.
7. International Journal of Applied Science – journal Elsevier Science.
8. Computers and Structures – journal Elsevier Science.
9. Journal of Sound and Vibration – journal Elsevier Science.

Course type: 15 L + 15 P

Assessment method: Lecture and exercises attendance, execute of design exercise.

Prerequisites:

Primary target group: Second cycle programme

Lecturer: Marek Pańtak, Ph.D.

Contact person: Marek Pańtak, Ph.D., tel. 628 29-13,
email: mpantak@pk.edu.pl

Deadline for application:

TITLE COURSE: **DESIGNING OF THIN-WALLED STEEL STRUCTURES**

Institute Division: Institute of Building Materials and Structures

Erasmus subject code: 06 4

Number of contact hours: 15

Course duration: 1 semester

ECTS credit: 2

Course description: The one-semester course is focused on the designing of steel thin-walled structures in which the post-buckling reserve of strength is to be utilized. It concerns steel girders, cold-rolled sections and steel panels. The course is devided into five (5) following topics:
1) Post-buckling reserve of strength in steel structures.
Designing transversally stiffened girders according to EC.
2) Peculiar cases of post-buckling behaviour of thin-walled girders and columns.
3) SIN girders. Usage and designing.
4) Use of adhesives in steel structures.
5) Thin-walled cold- formed profiles. Remarks on production
and usage. Tests on the roof light-coverage system.

Literature: Piekarczyk M., Taking Advantage of Post-Buckling Strength in Designing of Steel Structures, Monograph , 299, Politechnika Krakowska, Cracow 2004
European Steel Design Education Programme ESDEP WG 9, THIN-WALLED CONSTRUCTION,Lectures, 91-93.
Trahair N.S. et al, The Behaviour and Design of Steel Structures to EC3, 4th ed. Taylor & Francis. London & New York, 2008

Course type: 15 L

Assessment method: test

Prerequisites: Graduation in Basic Course on Metal Structures

Primary target group: 4 th, 5 th year civil engineering students

Lecture: Marek Piekarczyk, Ph. D., D. Sc., prof. CTU

Contact person: Prof. Marek Piekarczyk, Ph D. D.Sc, prof. CTU
phone: + 48 12 628 23 27, +48 12 628 23 24
e-mail mpiekar@usk.pk.edu.pl

Deadline for application June 30 or November 30

COURSE TITLE: **DURABILITY OF BUILDINGS**

Institute / Division: Institute of Building Materials and Structures

Erasmus subject code: 06 4

Number of Contact hours: 15

Course duration: 1 semester

ECTS credits: 1

Course description: Lectures: Durability and estimated lifetime of building constructions. Processes of concrete corrosion. Processes of steel corrosion. Processes of corrosion of reinforcement immersed to concrete. Corrosive agents – classification. Durability of concrete structures – surface protection and structure protection. Durability of metal structures – surface protection. Rules of corrosion protection depending on building materials, their technology and corrosion environment.

Literature:

[1] Corrosion in reinforced concrete structures, ed. By Hans Bohni, 2005
[2] Bertolini Luca [et al.]: Corrosion of steel in concrete : prevention, diagnosis, repair, Wiley, 2004
[3] Durability of concrete and cement composites, ed. by C.L.Page and M.M.Page, CRC Press, 2007
[5] Gjorv Odd E.: Durability design of concrete structures in severe environments, New York, 2009
[6] Neville A.M.: Properties of concrete, 4th edition, 1996

Course type: 15L

Assessment method: Final exam

Prerequisites: Basic knowledge about building materials, concrete constructions and metal constructions

Primary target group: undergraduate students

Lecturer: Dominika Dębska, Ph.D

Contact person: Dominika Dębska, Ph.D (ddebska@pk.edu.pl, tel. 23-45)

Deadline for application: June 30 or November 30

COURSE TITLE: **INTRODUCTION TO FINITE ELEMENT CODE – ABAQUS**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 15

Course duration: 1 semester

ECTS credits: 2

Course description: ABAOUS belongs to powerful engineering simulation programs, based on the finite element method, which can solve problems ranging from relatively simple linear analyses to the most challenging nonlinear simulations. This one-semester course is focused on giving students guidance in creating engineering structures (solids, shells) in ABAOUS/Standard module, analyzing these models and viewing results. To benefit from this course, some previous exposure to the finite element method is recommended.

First part of the course is centered on a simple example, covers the basis of using ABAOUS. By the end of this part students will know the fundamentals of how to prepare a model for an simulation, check the data, run the analysis job, and view the results (the models of the cantilever beam and overhead hoist). The difference between fuli and reduced integration is discussed. The illustration of numerical problems -hour glassing and shear locking is also done.

The following part of the course presents an overview of the main element families. The use of continuum (solid) elements, shell elements, and beam elements is discussed next. The use of three-dimensional, continuum elements to model the connecting ług is shown. The students will be also asked to model the skewed piąte, determine the midspan deflection of this structure and assess whether a linear analysis is valid for this problem. The next task will be an identification of the critical members and joints in the cargo crane.This course covers stress/displacement simulations, concerning linear static analyses.

Literature: *Introduction to ABAOUS Standard, ABAOUS UserManuar*

Course type: Lectures and lab sessions

Assessment method:	Evaluation of the project given by tutor
Prerequisites:	The theory of Finite Element Method
Primary target group:	4* year students
Lecturer:	Piotr Mika, Ph.D.
Contact person:	Piotr Mika, phone: +48 12 628 25 49, e-mail: plmika@cyfronet.krakow.pl
Deadline for application:	June 30 or November 30

COURSE TITLE: **MODELLING OF THE ENGINEERING PROBLEMS IN MATLAB BY MEANS OF THE FINITE ELEMENT METHOD**

Institute / Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: Finite Element Method (FEM) is a basic solution approach for practical analysis of the boundary value problems of mechanics and civil engineering. This course is oriented on implementation of the FEM based algorithms using Matlab package, especially in 2D problems. Applied will be only the simplest and well-known Matlab functions e.g. in order to generate mesh, build element approximation as well as generate appriopriate system of algebraic equations and perform the final results postprocessing. The following problems will be discussed and solved:

- general Poisson problem,
- stationary heat flow analysis,
- plane stress,
- plate bending.

Students will have a chance to learn how to program most of the fundamental steps of the FEM algorithm, which are usuallly ommited while dealing with other codes and comercial software.
Students will be encouraged to implement presented algorithms on their own, individually or while working in small groups.

Text books: O. C. Zienkiewicz, Richard Lawrence Taylor, Robert Leroy Taylor, “The finite element method for solid and structural mechanics”, Butterworth-Heinemann, 2005

Course type: 30 Lab.

Assessment method: Laboratory assignments

Prerequisities Numerical Methods, Informatics, Computational Methods

Primary target groups: Students of civil engineering (graduate level)

Lecturer: Sławomir Milewski, PhD

Contact person: Sławomir Milewski, phone (+48 12) 628 2563
e-mail: slawek@L5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **THEORY AND PRACTICE OPTIMIZATION –**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: The objective of the course is to explain the concepts, capabilities and applicability of optimization. The algorithms presented will be illustrated by solution of numerous examples stemming from mechanics, civil engineering and every day life. The course outline is as follows.

- Introduction (engineering examples, statement and classification of an optimization problems)
- Linear programming (formulation, definitions and theorems, simplex algorithm)
- Quadratic programming in 1D (accelerated step size search methods, Fibonacci and golden section methods, interpolation methods)
- Unconstrained minimization methods (random search, conjugate gradient, Newton's method)
- Constrained optimization techniques (random search methods, methods of feasible directions, interior and exterior penalty function methods, convergence criteria, discretization and structural optimization)
- Review of various other methods (integer programming, probabilistic programming, multi-objective optimization, genetic algorithms, neural network based optimization, optimization of fuzzy systems)

Students are supposed to practice the algorithms presented during lectures in the Matlab environment.

Text book: S. Rao, "*Engineering Optimization - Theory and Practice*", J. Wiley 1996

Course type: 10 L + 20 Lab.

Assessment method: Laboratory assignments and two tests given in class

Prerequisites: Numerical methods, continuum mechanics

Primary target group: Postgraduate students of engineering

Lecturer: Witold Cecot, PhD, DSc

Contact person: Witold Cecot, phone (+48 12) 628 21 67,
e-mail: plcecot@cyf-kr.edu.pl

Deadline for application: June 30 or November 30

2 COURSE TITLE: PRECAST CONCRETE STRUCTURES PART

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 5

Course description: The teaching process is focused on the introduction of the fundamentals of technology and design of precast concrete structures including especially procedures of check of every work phase. Several details specific for precast structures are widely discussed together with their evaluation methods. Practical exercises carried out in parallel includes a selected part of a design of a typical precast concrete structure.
The teaching process is focused on the introduction of the fundamentals of PC structures design including procedures of check of every design phase. Moreover, the presentation includes a wide information on the technology as well as on requirements of quality. Several workshop meetings on building sites complete the teaching course. In parallel, practical exercise is carried out which includes a complete design of a typical PC structure (slab, girder).

Literature:

K. S. Elliot, Multi-Storey Precast Concrete Framed Structures

A. Ghali, R. Favre – Concrete structures – stresses and deformations, E&FN Spon
A. Naaman – Prestressed concrete analysis and design, Techno Press 3000 Ann Arbor, MI
E. G. Nawy – Prestressed concrete – a fundamental approach, Prentice Hall Intl.

Course type: 15L + 15 P

Assessment method: Final exam including verification of theoretical assumptions of design for a selected element specific for this type of structures.

Prerequisites: Mechanics, Structural mechanics, Strength of Materials, Concrete technology, Building materials

Primary target group: 4st year students – graduate students

Lecturer: Wit Derkowski, Ph.D, Sylwia Schoenowitz –Żuradzka, M.Sc.

Contact person: Wit Derkowski, Ph.D; e-mail: derkowski@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **SELECTED PROBLEMS OF BRIDGE ENGINEERING**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 2

Course description: **Lecture:** Basic definition and terminology used in bridge engineering (components of bridges, function of main components, major types and structural systems of bridges, accessory of bridges). History of development of bridges. New materials in bridge engineering. Methods of brides erection. Methods of calculation of bridges load capacity.
Design exercises: Project of railway composite beam bridge (conceptional drawings of the bride, static and load capacity calculation of the bridge – strength of main girder, deck slab, shear connector).

Literature:

1. Furtak K.: Mosty zespolone, PWN, 1999 r.
2. Furtak K.: Podstawy mostów zespolonych. Podręcznik akademicki. Politechnika Krakowska, 1999 r.
3. Furtak K. Wstęp do projektowania mostów, Politechnika Krakowska, 1999 r.
4. Leonhardt F.: Podstawy budowy mostów betonowych, WKŁ, Warszawa, 1982 r.
5. Kmita K.: Mosty betonowe. Cz I i II. Inżynieria komunikacyjna. WKŁ, Warszawa, 1984 r.
6. Madaj A., Wołowicki W.: Mosty betonowe, wymiarowanie i konstuowanie. WKŁ, Warszawa 1998 r.
7. Madaj A., Wołowicki W.: Podstawy projektowania budowli mostowych", WKŁ, Warszawa, 2003 r.
8. Wołowicki W., Ryżyński A. i inni: Mosty stalowe, PWN, Warszawa-Poznań, 1984 r

Course type: 15 L + 15 P

Assessment method: Lecture and exercises attendance, execute of design exercise, final written examination.

Prerequisites:

Primary target group: First cycle programme

Lecturer: M. Pańtak, Ph.D., tel. 628 29-13,
email: mpantak@pk.edu.pl

Contact person: M. Pańtak, Ph.D., tel. 628 29-13,
email: mpantak@pk.edu.pl

Deadline for application:

COURSE TITLE: **SOIL-STRUCTURE INTERACTION**

Institute/Division: Institute of Structure Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 4

Course description: Separate analysis of an underground structural system and foundations with subsoil versus more advanced analysis with regard to the soil-structure interaction. Simplified methods: Winkler's model of subsoil – it's drawbacks. Calculation with regard to structure interaction with subsoil modeling by an elastic medium. Elasto-plastic modeling of soils and structural materials: geological media (soils, rocks, concrete masonry). Modeling of soil-structure interaction problems by FEM. Comparison and discussion of sample analysis carried on with different material models for soil and structure materials.

Literature:
1. Atkinson J.H., Bransby P.L. (1978): The mechanics of soil. An introduction to critical state soil mechanics. McGHRAW-HILL
2. Head K.H. (1992): Manual of soil laboratory testing. Volume 1, Soil classification and compaction tests. Volume 2, Permeability, shear strength and compressibility tests. Volume 3, Effective stress tests. Second Edition. Halsted Press: an Imprint of JOHN WILEY & SONS, INC. New York – Toronto

Course type: 30 L + 30 P

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Soil mechanics

Primary target group: Students of the third year of the study

Lecturer: Prof. Bogumił Wrana, Ph.D, DSc.

Contact person: Prof. Bogumił Wrana, Ph.D, DSc.,
e-mail: wrana@limba.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **SPECIAL FOUNDATIONS AND GROUND IMPROVEMENT TECHNIQUES**

Institute/Division: Institute of Structure Mechanics

Erasmus subject code: 06.4

Number of contact hours: 60

Course duration: 1 semester

ECTS credits: 4

Course description: Special Foundations - Wells and caissons. Diaphragm walls. Retaining structures. Structures of reinforced soil. Ground Improvement Techniques - Surface strengthening (mechanically stabilization, binder sealing), soil replacement, static and dynamic compaction, vibro systems (vibrocompaction, stone columns), grouting, micropiles, jet grouting method, vertical wick drains, lightweight fill materials, geotextiles, slope stability: anchoring, nailing.

Literature:
1. Atkinson J.H., Bransby P.L. (1978): The mechanics of soil. An introduction to critical state soil mechanics. McGHRAW-HILL
2. Head K.H. (1992): Manual of soil laboratory testing. Volume 1, Soil classification and compaction tests. Volume 2, Permeability, shear strength and compressibility tests. Volume 3, Effective stress tests. Second Edition. Halsted Press: an Imprint of JOHN WILEY & SONS, INC. New York – Toronto.

Course type: 30 L + 30 P

Assessment method: Individual evaluation, computer tests

Prerequisites: Mathematics, Soil mechanics

Primary target group: Students of the third year of the study

Lecturer: Prof. Bogumił Wrana, Ph.D, DSc.

Contact person: Prof. Bogumił Wrana, Ph.D, DSc.,
e-mail: wrana@limba.wil.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **SURFACE STRUCTURES (PLATES AND SHELLS)**

Institute/Division: Institute for Computational Civil Engineering

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 4

Course description: The aim of the course is to present the mechanical behavior of surface structures (panels, plates and shells). Basic definitions and assumptions are presented first. The sets of equations for plates and shells (in particular shells of revolution and shallow shells) are derived, describing relations between displacement, strain and stress fields. For certain cases analytical (exact and approximate) solution methods are used. The finite element (FE) method is presented as the main computational tool especially efficient in the analysis of plates and shells. The issues of proper discretization and approximation are discussed together with selected benchmark examples. The results of FE computations are compared with the analytical solutions

Reading: O.C. Zienkiewicz, R.L. Taylor, “*The finite element method*”, McGRAW-HILL, 1991

Course type: 15 L + 15 Cl.,(individual design exercises)

Assessment method: Individual design exercise including analytical solutions and FEM computations, examination test

Prerequisites: Passed courses: strength of materials, structural mechanics, fundamentals of FEM

Primary target group:

Lecturer: Anna Stankiewicz, Ph.D.

Contact person: A. Stankiewicz, phone: +48 12 628 25 46;
e-mail: A.Stankiewicz@l5.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **TECHNOLOGY OF PREFABRICATION**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 30

Course duration: 1 semester

ECTS credits: 3

Course description: This course of technology of concrete prefabrication is divided into three parts: lecture, class and laboratory ones. Lecture part is focused on brief presentation of assortment of prefabrication units (concrete, reinforced concrete and prestressed ones) and their technology of production (e.g. pre-tension prestressed, vibro-pressed, thermal cured etc.).Classes and laboratory part deal with concrete technology for prefabrication (e.g. lightweight, self-compacting, wet, sand, fly-ash concretes) and quality control of prefabricates. Classes part is focused on preparing students to laboratory part. In laboratory part students carry out some exercises concerning practical design of some of mentioned above concretes and some quality control tests on small-sized prefabrication units.

Literature: Basic literature on concrete technology (e.g. Properties of concrete by A.M. Neville) and a few dozen European standards referred to prefabrication units.

Course type: 18 L + 4 Cl. + 8 Lab.

Assessment method: Review and evaluation of completed exercises and design assignments. Testing subject knowledge orally and on paper.

Prerequisites: Classroom with multimedia equipment and small-sized precast units to show, Concrete Technology Laboratory

Primary target group: Students having completed concrete technology main course and 1-2 semesters of reinforced concrete structures course.

Lecturer: Maciej Urban, Ph.D.

Contact person: Maciej Urban, Ph.D.; phone: +48 12 628 23 63;
e-mail: murban@imikb.wil.pk.edu.pl.

Deadline for application: June 30 or November 30

COURSE TITLE: **TUNNELS, CAR-PARK, UNDERGROUND PEDESTRIAN CROSSINGS**

Institute/Division: Institute of Building Materials and Structures

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 4

Course description: **Lecture:** Basic definition and terminology used in underground structures engineering (components of tunnels, car-park and underground pedestrian crossings, function of main components, major types and structural systems of underground structures and car-park, accessory of underground structures and car-park). Methods of tunnels design and erection. Examples of structures.
Design exercises: Project of urban underground pedestrian crossing (conceptual drawings of the structure, static and strength calculation of the structure).

Literature:

1. Furtak K., Kędracki M.: Podstawy budowy tuneli, Podręcznik PK, Kraków, 2005 r.
2. Bartoszewski J., Lessaer S.: Tunele i przejścia podziemne w miastach. WKŁ, Warszawa, 1971 r.
3. Gałczyński S.: Podstawy budownictwa podziemnego. Oficyna Wdawnicza Politechniki Wrocławskiej, Wrocław, 2001 r.
4. Problemy podziemnej komunikacji miejskiej w Krakowie – materiały Konferencji Naukowo Technicznej, 26-27.11.2002 r.A. i inni: Mosty stalowe, PWN, Warszawa-Poznań, 1984 r.

Course type: 30 L + 15 P

Assessment method: Lecture and exercises attendance, execute of design exercise, final written examination.

Prerequisites:

Primary target group: Second cycle programme

Lecturer: Artur Czarnecki, Ph.D

Contact person: Artur Czarnecki, Ph.D., tel. 628 26-84, email: aczarnecki@pk.edu.pl

Deadline for application:

Faculty of Mechanical Engineering

TYPE & FIELD OF STUDIES:	**BSc (Eng.) in MECHANICS AND MACHINE DESIGN**
PROGRAM TITLE:	**ADVANCED COMPUTATIONAL MECHANICS (regular)**
Faculty/Department:	Faculty of Mechanical Engineering, Institute of Applied Mechanics
Duration:	7 semesters, regular course
Erasmus subject code:	06.1
ECTS credits:	210
Program description:	Advanced Computational Mechanics (ACM) is addressed for students who want to study contemporary problems in theoretical and applied mechanics with computer support. The program contains of the following general topics: basis in mathematics and physics, theoretical mechanics and strength of materials, material science and machining of structures, informatics and numerical methods, mechanics of solids, fluid mechanics, thermodynamics, theory of vibration and acoustics, automatic control and mechatronics, intelligent materials. Selected subject can be studied by Erasmus program students.
Programme of studies:	**Regular:** Basic mathematics (17 ECTS), Engineering mathematics I (4 ECTS), Distributions and transforms (2 ECTS,elect.), Physics (8 ECTS), Mechanics of particles and rigid body (8 ECTS), Vibrations and waves (4 ECTS), Strength of materials (11 ECTS), Elasticity theory (4 ECTS), Plasticity (2 ECTS), Fluid mechanics (4 ECTS), Information technology (2 ECTS), Computer science (4 ECTS), Numerical methods I (4 ECTS), Finite element method I (3 ECTS), Technical drawing (2 ECTS), AutoCAD (2 ECTS), Machine design (10 ECTS), Computer aided design of structures (2 ECTS), Material science I (8 ECTS), Plastics and composites (2 ECTS), Production engineering (3 ECTS), Computer aided machining of structures

(4 ECTS), Thermodynamics (5 ECTS), Electronics and electrical engineering (3 ECTS), Principles of automatic control engineering (5 ECTS), Elements of robotics (4 ECTS), Metrology (3 ECTS), Experimental methods in mechanics (2 ECTS), Environmental protection and ecology (1 ECTS), Physical education (2 ECTS), Foreign language (12 ECTS), Safety engineering and ergonomy (1 ECTS), Patents (1 ECTS), Practical training (4 ECTS), Seminar (12 ECTS), Final project (15 ECTS)

Total: 1635 h

Electives: Probability theory (2 ECTS), Variational calculus (2 ECTS), Statistics (2 ECTS),Vehicle constructions (2 ECTS), Fuel engines (2 ECTS), Theory of mechanisms and machines (2 ECTS), Manipulators (2 ECTS), Advanced mechanics of structures (2 ECTS), Constitutive modeling (2 ECTS), Optimization of structures (2 ECTS), Stability of structures (2 ECTS), Quantum mechanics (2 ECTS), Accelerator design (2 ECTS), Heat transfer (2 ECTS), Acoustics (2 ECTS), Introduction to mechatronics (2 ECTS), MEMS technology (2 ECTS), Modeling of materials in extremal temperatures (2 ECTS), Rheology (2 ECTS), Biomechanics (2 ECTS), Intelligent structures (2 ECTS), Computer programming (2 ECTS), Symbolic programs in mechanics (2 ECTS), Identification of dynamical systems (2 ECTS), Simulation (2 ECTS), Finite element method II (2 ECTS), Finite element method in fluid mechanics (2 ECTS), Signal processing (2 ECTS), Dedicated computer software for engineers (2 ECTS), Coordinate measuring systems (2 ECTS), Programming of CAD coordinate systems (2 ECTS), Noise and vibration protection (1 ECTS), Recycling (1 ECTS), Renewable natural energy sources (1 ECTS), Energy methods in mechanics (1 ECTS), Engineering data bases (1 ECTS), Ethics (2 ECTS), Management (2 ECTS)

Total: 765 h

Eligibility/Admission: Students who have finished BSc Course in

	Mechanical Engineering with diploma
Fees:	Free for EU, 4000 EUR per year for others
Contact person:	Marek S.Kozień, PhD, DSc, phone no.: +48 12 628 33 70
	e-mail: Marek.Kozien@pk.edu.pl
Application procedures:	Faculty recrutation in June/July

TYPE & FIELD OF STUDIES:	**MSc in MECHANICS AND MACHINE DESIGN**
PROGRAM TITLE:	**ADVANCED COMPUTATIONAL MECHANICS (regular)**
Faculty/Department:	Faculty of Mechanical Engineering, Institute of Applied Mechanics
Duration:	3 semesters, regular course
Erasmus subject code:	06.1
ECTS credits:	90
Program description:	Advanced Computational Mechanics (ACM) is addressed for students who want to increase their knowledge in mechanics and computer application in design of structures (CAD, FEM), material design (CAMD), material selection (CAMS), manufacturing (CAM) and monitoring of machines.
Programme of studies:	**Regular:** Advanced mathematics (4 ECTS), Engineering mathematics II (2 ECTS), Solid state physics (2 ECTS), Continuum mechanics (2 ECTS), Analytical mechanics (2 ECTS), Numerical methods II (2 ECTS), Object-oriented programming (1 ECTS), Material science II (4 ECTS), Modern structural materials (2 ECTS), Advanced modeling of materials and structures (5 ECTS), Modeling in machine design (4 ECTS), Integrated processing systems (3 ECTS), Advanced FEM modeling (4 ECTS), Advanced strength of materials (2 ECTS), Dynamics of mechanical systems (2 ECTS), Experimental mechanics of solids (2 ECTS),

	Individual project (5 ECTS), Seminar (3 ECTS), Final project (20 ECTS)
	Total: 675 h
	Electives: Computational fluid mechanics (2 ECTS), Computational thermodynamics and heat transfer (2 ECTS), Computational structural design (2 ECTS), Computational stability of structures (2 ECTS), Computational optimization of structures (2 ECTS), Computational vibro-acoustics (2 ECTS), Computational fluid mechanics (2 ECTS), Computational methods in automation control (2 ECTS), Computational mechatronics (2 ECTS), Continuum damage mechanics (1 ECTS), Advanced control of systems (1 ECTS), Intelligent structures (1 ECTS), Design of materials (1 ECTS), Optimal selection of materials (1 ECTS), Machine diagnostics (1 ECTS)
	Total: 255 h
Eligibility/Admission:	Students who have finished BSc course in Mechanical Engineering with diploma
Fees:	Free for EU, 4000 EUR per year for others
Contact person:	Marek S.Kozień, PhD, DSc, phone no.: +48 12 628 33 70
	e-mail: Marek.Kozien@pk.edu.pl
Application procedures:	Faculty recrutation in February and June/July

TYPE & FIELD OF STUDIES:	**MSc in MECHANICS AND MACHINE DESIGN**
PROGRAM TITLE:	**ADVANCED COMPUTATIONAL MECHANICS (for foreign students)**
Faculty/Department:	Faculty of Mechanical Engineering, Institute of Applied Mechanics
Duration:	4 semesters (2 academic years)

Erasmus subject code:	06.1
ECTS credits:	120
Program description:	Advanced Computational Mechanics (ACM) is playing an everincreasing role in the activities of many international scientific institutions, research and development laboratories as well as technological centres. ACM provides a support for many activities related to science and technologies, including the reliability engineering. The use of computers is now essential in the process of design and structural optimisation. It begins with the proper choice of modern materials and ends up with setting all the parameters of the final complex product. The aim of this Master Programme in Advanced Computational Mechanics is to provide the student with a solid scientific and technical basis of theoretical and applied mechanics and modern numerical methods. The programme includes compulsory lectures, tutorials, laboratories and practical exercises in computational mechanics. It is thought to equip the students with the set of tools needed in the professional life comprising scientific research, technological development and large European Projects.
Programme of studies:	*1st semester* Analytical Mechanics 60h, 6 ECTS Solid State Physics 30h, 4 ECTS Mathematical Modelling 30h, 4 ECTS Materials Science 45h, 5 ECTS Computer Methods for Eng. 45h, 5 ECTS Solid Mechanics 60h, 6 ECTS *2nd semester*

Modelling of Dynamical Sys. 30h, 4 ECTS

Continuum Damage Mechanics 30h, 3 ECTS

Fluid Mechanics 45h, 5 ECTS

Thermodynamics 45h, 5 ECTS

Stability of Structures 30h, 4 ECTS

Structural Optimisation 30h, 4 ECTS

Reliability of Structures 30h, 3 ECTS

3rd semester

Modelling in Machine Design 60h, 6 ECTS

Modern Structural Materials 30h, 4 ECTS

Integrated Processing Systems 60h, 6 ECTS

Object Oriented Programming 15h, 2 ECTS

Elective Subject 30h, 4 ECTS

Adv. Modelling of Mat. & Struct. 60h, 6 ECTS

Individual Project 90h, 9 ECTS

4th semester

Large Scale Europ. Projects 15h, 2 ECTS

Diploma Seminar 30h, 3 ECTS

Diploma Work 180h, 20 ECTS

Eligibility/Admission:	Students who have completed Bachelor Programme in Mechanical Engineering or related field and obtained Bachelor's Degree
Fees:	4000 EUR per year
Contact person:	Błażej Skoczeń, Prof., PhD, DSc, phone no.: +48 12 628 33 84 e-mail: blazej.skoczen@pk.edu.pl
Application procedures:	Documents listed at http://www.bwm.pk.edu.pl/Application_Procedure_for_MSc_studies_ in_Eng.pdf are to be submitted by **31 May** via e-mail to Ms. Jolanta Rak at jolar@pk.edu.pl

Institute of Machine Design

Henryk SANECKI, PhD, DSc., phone#: +48 12.374.33.87

Email: hsa@mech.pk.edu.pl

COURSE TITLE: MACHINE DESIGN

Course duration: 1 semester (30 hours of lectures)

Description: The course presents rules and methods used in machine design. It covers following areas: general design principles, failure of machine components and failure prevention design methods, typical machine joints like: welds, adhesive bonding, rivets, threaded connections, multi-screw joints and also interference fits. The course includes also essential knowledge concerning designing of springs and power transmission shafts, axles, clutches, brakes, plain and rolling bearings. The attention is also paid to power transmission units like gears and gear systems, belt and chain drives. All the knowledge presented during the course is supplemented by typical calculations of typical machine elements examples of designs.

Literature:

1. R. L. Norton, Machine Design. An Integrated Approach 3rd ed.
2. J. E. Shigley, C. R. Mischke, Standard Handbook of Machine Design, 2nd ed.
3. J. A. Collins, H. Busby, G. Staab, Mechanical Design of machine Elements and Machines, 2nd ed.

Course type: Lectures

Assessment method: Tests

Prerequisities: Strength of materials, Mechanics

Primary target group: preferably 3rd year of Mechanical Engineering students

Deadline for application: 31st of May.

Institute of Machine Design

Bogdan SZYBIŃSKI, PhD, , phone#: +48 12.374.33.88

Email: boszyb@mech.pk.edu.pl

COURSE TITLE: FINITE ELEMENT METHOD – THEORY AND APPLICATION IN MECHANICAL DESIGN

Course duration: 1 semester (15 hours of lectures + 30 hours of computer laboratory)

Description: The course presents the theoretical introduction and the basic ideas of the finite element method which is widely used in various fields of engineering calculations. Particular attention is paid to structural problems, which cover the strength analysis of beams, thin-walled members and solid structures. Beside the common linear static problems the nonlinear problems are also presented. The study is supplemented by the estimation of computational errors, which helps to evaluate the numerical solution quality. The approach to simple thermal, dynamic and stability problems is also presented in the course. The lectures are supplemented by the computer laboratory. In this part of course the FEM system ANSYS is used and the students learn how to operate the FEM system, build the model, introduce the loads and boundary conditions, set up the solution options and observe the results of calculation. In the final stage the analysis of approximation errors and the convergence studies are performed in order to estimate the quality of the numerical solution.

Literature:

1. O. C. Zienkiewicz, R. L. Taylor, The Finite Element Method for Solid and Structural Mechanics, 6th ed.
2. R. D. Cook, D. S. Malkus, M. E. Plesha, R. J. Witt, Concepts and Applications of Finite Element Analaysis, 4th ed.
3. G. R. Liu, S. S. Quek, The Finite Elements Method: A Practical Course, 1st ed.
4. E. Madenci, I. Guven, The Finite Element Method and Applications in Engineering Using ANSYS, 1st ed.

Course type: Lectures + computer laboratory

Assessment method: Tests and exercises to solve in laboratory classes

Prerequisities: Strength of materials, Mechanics

Primary target group: preferably 3rd year of Mechanical Engineering students

Deadline for application: 31st of May.

Institute of Machine Design

Bogdan SZYBIŃSKI, PhD, , phone#: +48 12.374.33.88

Email: boszyb@mech.pk.edu.pl

COURSE TITLE: FINITE ELEMENT METHOD – THEORY AND APPLICATION IN MECHANICAL DESIGN

Course duration: 1 semester (15 hours of lectures + 30 hours of computer laboratory)

Description: The course presents the theoretical introduction and the basic ideas of the finite element method which is widely used in various fields of engineering calculations. Particular attention is paid to structural problems, which cover the strength analysis of beams, thin-walled members and solid structures. Beside the common linear static problems the nonlinear problems are also presented. The study is supplemented by the estimation of computational errors, which helps to evaluate the numerical solution quality. The approach to simple thermal, dynamic and stability problems is also presented in the course. The lectures are supplemented by the computer laboratory. In this part of course the FEM system ANSYS is used and the students learn how to operate the FEM system, build the model, introduce the loads and boundary conditions, set up the solution options and observe the results of calculation. In the final stage the analysis of approximation errors and the convergence studies are performed in order to estimate the quality of the numerical solution.

Literature:

5. O. C. Zienkiewicz, R. L. Taylor, The Finite Element Method for Solid and Structural Mechanics, 6th ed.
6. R. D. Cook, D. S. Malkus, M. E. Plesha, R. J. Witt, Concepts and Applications of Finite Element Analaysis, 4th ed.
7. G. R. Liu, S. S. Quek, The Finite Elements Method: A Practical Course, 1st ed.
8. E. Madenci, I. Guven, The Finite Element Method and Applications in Engineering Using ANSYS, 1st ed.

Course type:	Lectures + computer laboratory
Assessment method:	Tests and exercises to solve in laboratory classes
Prerequisities:	Strength of materials, Mechanics
Primary target group:	preferably 3rd year of Mechanical Engineering students
Deadline for application:	31st of May.

COURSE TITLE: **MECHANICS OF COMPOSITES**

Institute/Division: Institute of Machine Design/ Faculty of Mechanical Engineering

Erasmus subject code:

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: Lecture: The main goal of the "Mechanics of Composites" lecture is to demonstrate differences between mechanical descriptions of composites and typical engineering materials. First of all, the classification of composite materials, the description of both reinforcements and matrices and the basic concepts are introduced. The experimental measurements, the stress-strain curves, and the transition between anisotropic material and isotropic are presented with the help of the various forms of the stiffness matrix in the elastic range. The significant influence of temperature, humidity and time on the mechanical properties of composites is clearly shown. Besides, the laminate configuration, particularly in the 2D case, the description of mechanical properties of individual layers, and the transformations between the local and the global coordinate systems are pointed out. In the topic of composite failure several modes of composites damages in case of static and dynamic loads are demonstrated. Moreover, the kinematic hypothesizes applied in 2D composite structures deformation description, the local, the local-global and the global explanations are presented. The basic relations for 2D plates and shells formulated with the help of static hypothesizes, the Hamilton's, Lagrange's, and Hellinger-Reissner's principle are illustrated. Finally, some examples of the buckling and optimization of composite structures are also discussed.

Literature: Christiansen R.M., Mechanics of Composite Materials, Wiley, New York, 1979; Altenbach H., Altenbach J.W., Kissing W., Mechanics of Composite Structural Elements, Springer, 2004.

Course type:	Lectures
Assessment method:	Final test from lectures
Prerequisites:	solid state mechanics
Primary target group:	3rd year Mechanical Engineering students
Lecturer:	Aleksander Muc, Professor
Contact person:	Aleksander Muc, Professor, phone #: +48 12 628 3350, e-mail: olekmuc@mech.pk.edu.pl
Deadline for application:	June 30 or November 30

Institute of Machine Design

Henryk SANECKI, PhD, DSc., phone#: +48 12.374.33.87

Email: hsa@mech.pk.edu.pl

COURSE TITLE: MACHINE DESIGN

Course duration: 1 semester (30 hours of lectures)

Description: The course presents rules and methods used in machine design. It covers following areas: general design principles, failure of machine components and failure prevention design methods, typical machine joints like: welds, adhesive bonding, rivets, threaded connections, multi-screw joints and also interference fits. The course includes also essential knowledge concerning designing of springs and power transmission shafts, axles, clutches, brakes, plain and rolling bearings. The attention is also paid to power transmission units like gears and gear systems, belt and chain drives. All the knowledge presented during the course is supplemented by typical calculations of typical machine elements examples of designs.

Literature:

4. R. L. Norton, Machine Design. An Integrated Approach 3rd ed.
5. J. E. Shigley, C. R. Mischke, Standard Handbook of Machine Design, 2nd ed.
6. J. A. Collins, H. Busby, G. Staab, Mechanical Design of machine Elements and Machines, 2nd ed.

Course type: Lectures

Assessment method: Tests

Prerequisities: Strength of materials, Mechanics

Primary target group: preferably 3rd year of Mechanical Engineering students

Deadline for application: 31st of May.

COURSE TITLE: **HYDRAULIC AND PNEUMATIC DRIVE AND CONTROL**

Institute/Division: Institute of Machine Design/ Faculty of Mechanical Engineering

Erasmus subject code:

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: Lecture: Fluid power system – hydrostatic, hydrokinetic and pneumatic. Working fluids: mineral oils, synthetic oils, biodegradable and water. Basic working parameters of fluid power systems. Symbols and schema building rules of the fluid power system. The construction, principle of operation and basic characteristics of the hydraulic pumps, motors and linear actuators. Basic types and characteristics of control valves for; pressure, flow and direction control. Other hydraulic system components, as: filters, tanks, coolers, pipes and hoses, connectors, seals, measurement and controls. The hydrostatic drive and control system of typical machines. Throttle and volume control of the actuator velocity. Hydrostatic transmission, definition, control characteristics. Fundamentals of fluid power system design. Hydrokinetic clutches and torque converters – Basic operations characteristics.
Laboratory: Positive displacement pump characteristic testing. Pressure relief and/or flow control valve characteristics investigation. Pneumatic cylinder efficiency testing. Velocity control system by use of throttle valve. Testing of hydrokinetic clutch characteristic testing. Mobile machines hydrostatic steering system testing.

Literature: J. S. Stecki and A. Garbacik, Hydraulic Control Systems - System Design and Analysis, Fluid Power Net Publications, 2000; J. Watton, Modeling, monitoring and diagnostic techniques for fluid power systems, Springer-Verl. 2007; / J. S. Cundiff Fluid power circuits and controls : fundamentals and applications A.K., CRC Press, Boca Raton; cop. 2002.

Course type:	Lectures and laboratory
Assessment method:	Final test from lectures plus reports and tests from laboratory
Prerequisites:	physics, machine theory, fluid mechanics
Primary target group:	3rd year Mechanical Engineering students
Lecturer:	Andrzej Sobczyk, PhD
Contact person:	Andrzej Sobczyk, PhD, phone #: +48 12 628 3405, e-mail: sobczyk@mech.pk.edu.pl
Deadline for application:	June 30 or November 30

COURSE TITLE: **Automotive Structures**

Institute/Division: Automotive Construction Chair / Institute of Vehicles and Combustion Engines / Mechanical Faculty

Erasmus subject code: 06.1

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: LECTURES: Automotive construction features; exploitation universality, man-machine cooperation, mass production, active and passive safety, simplicity of repair and maintenance, durability, reliability, evaluation methods. Drivetrain configurations. Function of an automotive clutches, description of clutch construction, single and multiplate clutches, self adjustment construction solution. Clutch main dimensions calculation. Diaphgram spring force calculation. Function of a gearbox. Description of gearbox construction solutions. Synchromesh, Double clutch gearbox. Introductory calculation of gearbox elements; gearwheel, shafts. Hydrodynamic couplings, and hydrodynamic torque converters, automatic transmissions, planetary gear-sets, operation, construction, description. Continuously variable transmission. Drive shaft construction, universal and constant velocity joints. Final drive units construction solution description, introductory calculation of final drive elements, bearings. Differential units, operation and description of construction solution. Visco and Haldex couplings, description and operation. Rigid live axle, axle shaft, axle shaft bearings. Requirements for suspension mechanism. Types of suspension and their characteristics, suspension design elements calculation. Shock absorber operation and construction. Controlled suspension systems, active suspension. Braking system, legal regulation and requirements, design and components of braking system. Basic equation for braking system elements, ABS antilock braking system, ABS version, ABS control cycle, ASR

traction control. Vehicle dynamics control (VDC) for passenger car, control system components, system realization. Steering, types of steering box, steering kinematics, power assisted steering.
LABORATORY CLASSES; Clutch diaphgram spring characteristic designation, Vehicle mass geometry designation, Vehicle suspension characteristic designation, Vehicle roll characteristic designation, Steering system kinematics designation, Vacuum assisted brake system characteristic designation

Literature:

Course type: Lectures, laboratory classes

Assessment method: Final test

Prerequisites: Theoretical mechanics, thermodynamics

Primary target group: 3 rd year Automotive Engineering (lectures only) undergraduate studies (4 years) leading to the degree of equivalent to an BSc, or 1st year Automotive Engineering (full course) of graduate studies (1,5 year) leading to the degree of equivalent to a MSc

Lecturer: Witold Grzegożek, DSc., DEng

Contact person: Witold Grzegożek, DSc., DEng,; phone #: +48 12 6283526
e-mail: witek@mech.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: FLUID MECHANICS

Institute/Division: Institute of Process and Power Engineering / Faculty of Mechanical Engineering

Erasmus subject code: 06.4

Number of contact hours: 45

Course duration:

ETCS credits: 5

Course description:	Macroscopic properties of fluids. Kinematics of fluid motion. Eulerian and Lagrangian flow descriptions. Volume and mass rate of flow. The continuity equation. Surface and volume forces. Euler’s equation of equilibrium. Forces acting on the vessel off liquid. Euler’s equation of motion. The Navier-Stokes equations. Solutions of the steady-state Navier-Stokes equations. The Poiseuille and Couette flows. Flow of an Ideal Fluid. Bernoulli’s equation. Application of Bernoulli’s equation. Viscous flow in pipes. Laminar and turbulent flow in pipes. Pressure loss by pipe friction. Flow measurements. Instruments and procedures for measurement of flow rate.
Literature:	B. R. Munson, D. Young, T. Okiishi, Fundamentals of Fluid Mechanics, J. Wiley& Sons, W. P. Graebel, Advanced Fluid Mechanics, Elsevier.
Course type:	Lectures, classes and laboratory
Assessment method:	Exam
Prerequisites:	
Primary target group:	1st year postgraduate Mechanical Engineering students
Lecturer:	Stanisław Walczak, PhD, Eng., MSc Eng. Bartosz Kopiczak
Contact person:	Stanisław Walczak, PhD, phone # +48 126283270 e- mail: swalczak@mech.pk.edu.pl
Deadline for application:	June 30 or November 30

TYPE & FIELD OF STUDIES: **MSc in MANAGEMENT AND PRODUCTION ENGINEERING**

PROGRAM TITLE: **LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

Faculty/Department: Faculty of Mechanical Engineering

Duration: 4 semesters

ECTS points: 180

Programme of studies: A. Human Resources Management, Manage Competencies and Personnel Development Interpersonal Communication, Selected

Problems in Technique and Technology, Modern Structural Materials, Structural strength and durability, Hybrid Systems of

Manufacturing, Fundamentals of Manufacturing Processes, Geometrical Product Specification and Measuring Systems, Reverse Engineering, Environmental Preservation and Recycling;

B. Enterprise Management, Business Process Reengineering, Enterprise Information Systems, Virtual Enterprises, e-Business, Integrated Management Systems (ERP, MRP), International Management;

C. Forecasting and Simulation, Forecasting Methods, Simulation of Logistics Systems;

D. Project and Innovation Management, Project Management and Risk Analysis, Market Analysis, Searching for Innovative Solutions, Product Lifecycle Management , Quality Management Systems;

E. Logistics Management, Aided Decision - Making Systems,

Artificial Intelligence in Management, Expert systems in Logistics management, Logistics Audit;

F. Logistics Systems and Devices, Auxiliary Transport Devices Logistics Systems in Enterprises, Regional and International Logistics Systems, Mid-term paper, Graduation seminar;

G. Dissertation

Eligibility: Students who have completed Bachelor Program in Mechanical Engineering or related field and earned Bachelor's Degree

Tuition fee: 4000 EUR per year

Contact person: Krzysztof Karbowski, PhD, DSc, phone#: +48 12 628 32 47

e-mail: karbowski@mech.pk.edu.pl

Application procedures & deadlines: Documents listed at

http://www.bwm.pk.edu.pl/Application_Procedure_for_MSc_studies_in_Eng.pdf

are to be submitted by **31 May** via e-mail to Ms. Jolanta Rak jolar@pk.edu.pl

TYPE & FIELD OF STUDIES: **BSc IN COMPUTER SCIENCE**

PROGRAMME TITLE: **COMPUTER SCIENCE**

Faculty/ Department: Faculty of Mechanical Engineering / Institute of Applied Computer Science

Duration: 7 semesters (3.5 academic years)

Erasmus subject code: 11.3, 06.1

ECTS credits 210

Programme description: This course fulfils basic standards of informatics, including major lectures from the area of algorithms and data structures, microprocessors and architecture of computers, numerical methods, operating systems, programming languages, computer networks, computer graphics, databases, artificial intelligence. The study gives a professional knowledge which allows our graduates for efficient developing and programming applications using C++, Java, PHP etc., designing computer networks and databases. This course also prepares students for designing and working with mechanical engineering applications. Our graduates can work as software developers, network designers, programmers, testers or system administrators in a big sector of software developing companies, engineering industry, industrial plants, banks etc.

Programme of studies: *A. GENERAL EDUCATION 300h, 14 ECTS*

1. Foreign language 120 h, 5 ECTS
2. Humanistic courses 120h, 9 ECTS
   2.1 Economics / Management and marketing (1 of 2) 30h, 2 ECTS
   2.2 Ethics / Philosophy / Sociology (1 of 3) 30h, 2 ECTS
   2.3 Social and vocational problems of informatics 30h, 3 ECTS
   2.4 Industrial safety and ergonomics 15h, 1 ECTS
   2.5 Protection of intellectual properties 15h, 1 ECTS
3. Physical training 60 h, 0 ECTS

B. BASIC COURSES 660h, 61 ECTS

1. Mathematics 315h, 29 ECTS
2. Physics and technical sciences 135h, 14 ECTS
3. Basics of computer programming 210h, 18 ECTS
   3.1 Programming languages and techniques 60h, 7 ECTS
   3.2 Basics of internet languages 30h, 2 ECTS
   3.3 Object oriented programming 60h 4 ECTS
   3.4 Basics of database programming 45h, 3 ECTS

C. FIELD COURSES 1110h, 91 ECTS

1. Algorithms and data structures 60h, 6 ECTS
2. Microprocessors and computer architecture 45h, 4 ECTS
3. Operating systems 45h, 5 ECTS
4. Software design methodologies and notations 45h, 3 ECTS
5. Computer graphics 60h, 5 ECTS
6. Computer networks 60h, 5 ECTS
7. Modeling and visualization 60h, 4 ECTS
8. Design and management of databases 45h, 5 ECTS
9. Informatics metrology 30h, 2 ECTS
10. Finite elements method 60h, 3 ECTS
11. Communication human – computer 30h, 2 ECTS
12. Basics of multimedia techniques 30h, 2 ECTS
13. Operational graphics and DTP 30h, 2 ECTS

14. Methods and systems of knowledge engineering 30h, 2 ECTS

15. Software engineering 45h, 4 ECTS

16. Microcontrollers and signal processing 30h, 2 ECTS

17. Group project 60h, 5 ECTS

18. Image analysis 45h, 5 ECTS

19. Neural networks and genetic algorithms 30h, 3 ECTS

20. Real time systems 30h, 3 ECTS

21. Experiment and measurement planning DOE 30h, 3 ECTS

22. Optional courses 120h, 12 ECTS

Industrial Training 4 weeks, 4 ECTS

D DIPLOMA COURSE 1: Software engineering 240h, 40 ECTS

1. Programming of mobile systems 30h, 3 ECTS
2. CMMI and other quality management systems 30h, 3 ECTS
3. .NET and C# technologies 45h, 4 ECTS
4. Management of informatics systems 45h, 4 ECTS
5. Production of informatics systems 30h, 3 ECTS
6. Administration and security of computer systems 30h, 3 ECTS
7. Diploma Seminar 30h, 3 ECTS
8. Diploma Thesis 0h, 15 ECTS

E. DIPLOMA COURSE 2: Industrial informatics 240h, 40 ECTS

1. Measurement and automation systems 30h, 3 ECTS
2. Advanced CAD systems 30h, 3 ECTS
3. CAE systems 45h, 4 ECTS
4. Engineering applications in C++ and Delphi 45h, 4 ECTS
5. Computer industrial networks 30h, 3 ECTS
6. Administration and security of computer systems 30h, 3 ECTS
7. Diploma Seminar 30h, 3 ECTS
8. Diploma Thesis 0h, 15 ECTS

Web page: http://www.m7.mech.pk.edu.pl

Eligibility / Admission: Applicants should have earned high school diploma (International Baccalaureate or equivalent)

Tuition fee: 2000 Euro per semester

Contact person: Edward Lisowski, Prof. DSc, PhD;
phone #: +48 12 628 33 51,
e-mail: lisowski@mech.pk.edu.pl

Application procedures & deadlines: Documents listed at http://www.bwm.pk.edu.pl/Application_Procedure_for_BSc_studies_in_Eng.pdf are to be submitted by **31 May** via e-mail to Ms. Kamila Rościszewska at kamir@pk.edu.pl

COURSE TITLE: **OBJECT ORIENTED PROGRAMMING**

Institute / Division: Institute of Applied Informatics / Faculty of Mechanical Engineering

Erasmus subject code: 11.3

Number of contact hours: 60

Course duration: 2 semesters

ECTS credits 4

Course description: Advantages of object oriented analysis and design. Object oriented strategies and programming

	languages. Fundamentals of object oriented programming: classes, objects, class members. Using constructors and destructors. Basic notions and concepts: abstraction, encapsulation, inheritance, polymorphism. Virtual and pure virtual class members, abstract classes. Multiple and multigenerational inheritance. Overloading of operators. Working with templates. Container classes as example of practical using of templates. Elements of software engineering: design and using of UML diagrams and design patterns.
Literature:	G. Booch, The UML User Guide, Addison-Wesley; ISBN 0-201-57168-4 C. Kak Object Oriented Programming, Jon Wiley & Sons, New York 2003 J. Keogh, M. Giannini OOP Demystified, McGraw-Hill Professional, ISBN 0-07-225363-0 T. Budd, Introduction to Object-Oriented Programming, Addison-Wesley, 1991
Course type:	Lectures, computer laboratory and projects
Assessment method:	Attendance, final project and test
Primary target group:	1st and 2nd year students of computer science
Lecturer:	Grzegorz Filo, PhD
Contact person:	Grzegorz Filo, PhD; phone: +48 12 628 33 35, e-mail: filo@mech.pk.edu.pl
Deadline for application:	May 31

COURSE TITLE:	**ENGINEERING GRAPHICS**
Institute / Division:	Institute of Applied Informatics / Faculty of Mechanical Engineering
Erasmus subject code:	06.1
Number of contact hours:	45
Course duration:	2 semesters
ECTS credits	3
Course description:	Theoretical base of parametric curves and surfaces notation. Curves in CAD systems. Parametric

polynomial curves. Segment of Hermit and Bezier curve. Uniform and non-uniform non-rational B-splines. Properties of base functions in B-splines. Notation of non-uniform rational B-splines: NURBS. The Coons surface. Parametric bi-cubic surfaces. Classes of continuity. Computer programs for creating vector 2D graphics: Autocad, Intercad, DWGEditor. Creating of document templates, basic commands, configuration. Essentials and methodology of creating 2D engineering drawings. First angle projection, views and intersections. Simplified drawings of screw joints, welds etc. Placing designations of tolerances and fittings. Creating of diagrams, schemes and charts.

Literature: F. E. Giesecke and others, Technical Drawing, Pretience Hall, New York 2006

Course type: Lectures, computer laboratory and projects

Assessment method: Attendance, passing projects and test

Primary target group: 2nd year students of computer science

Lecturer: Wojciech Czyżycki, PhD

Contact person: Wojciech Czyżycki, PhD; phone: +48 12 628 36 54, e-mail: czyzycki@mech.pk.edu.pl

Deadline for application: May 31

COURSE TITLE: **MODELLING AND VISUALIZATION**

Institute / Division: Institute of Applied Informatics / Faculty of Mechanical Engineering

Erasmus subject code: 06.1

Number of contact hours: 60

Course duration: 1 semester

ECTS credits 4

Course description: Essentials of solid 3D modelling. Methodology of creating 3D models of parts. Using of sketcher. Steps in design process of 3D solid model. Examples of part models. Creating assemblies. Modelling of helical cut-outs and extrudes. Practice of solid modelling in Autodesk Inventor, Solid Works and Pro/Engineer systems. Visualization of part and assembly models: setting material properties, texturing.

Literature: E. Lisowski, Modelling geometry of elements, assemblies and kinematics of machines in program Pro/Engineer Wildfire, Bergen 2005

Course type: Lectures, computer laboratory and projects

Assessment method: Attendance, passing laboratories and final project

Primary target group: 2nd year students of computer science

Lecturer: prof. Edward Lisowski, PhD, DSc

Contact person: prof. Edward Lisowski, PhD, DSc;
phone: +48 12 628 33 35,
e-mail: lisowski@mech.pk.edu.pl

Deadline for application: May 31

TYPE & FIELD OF STUDIES: **MSc IN MECHANICS AND MACHINE DESIGN**

PROGRAMME TITLE: **COMPUTER AIDED DESIGN IN MECHANICAL ENGINEERING**

Faculty/ Department: Faculty of Mechanical Engineering / Institute of Applied Informatics

Duration: 4 semesters

ECTS credits 120

Programme description: This is a MSc course for BSc graduates. It is mainly focused on improving students' skills in application of computer science: CAD, CAM and CAE systems, programming, artificial intelligence, computer networks. Nowadays engineers must be skilled in many fields of computer science. The study gives a professional knowledge which allows our graduates for efficient using of CAD 2D and 3D systems as AutoCad, Intercad, Pro/E, Inventor, Solid Works. The students will be able to carry out computation of structural strength using Pro/Mechanica or Cosmos Works and develop computer programs using Delphi, C++ or Java. They will know how to solve construction problems with the most modern software and automatize their work using programming environments. Our graduates can work in a big sector of engineering industry including machine building, automotive companies, aircraft industry and many others.

Programme of studies:

	Hours	ECTS
1st semester		
Computer Methods using software Maple	60	6
CAD 2D systems	60	5
CAD 3D systems	60	5
Simulation of drives and control systems	30	4
Advanced computer networks	30	5
Basics of programming	60	5
2nd semester		
Computer graphics	30	4
Advanced CAD systems	60	7
FEM systems	60	6
Object oriented programming	60	5
Integrated CAD systems: Pro/E	60	5
Computer networks	30	3
3rd semester		
Administration and security of informatic systems	30	4
Design of mechanisms	75	6
CFD systems	60	6
Automation of CAD systems	30	4
FEM systems – Pro/Mechanica	60	6
Intelligent systems	45	4

4th semester		
Image analysis	30	5
Diploma seminar	30	5
Diploma thesis	0	20

Web page: http://www.m7.mech.pk.edu.pl

Eligibility / Admission: Students who have completed Bachelor Program in Mechanics and Machine Design or related and who obtained Bachelor's Degree

Tuition fee: 2000 Euro per semester

Contact person: Edward Lisowski, Prof. DSc, PhD;
phone #: +48 12 628 33 51,
e-mail: lisowski@mech.pk.edu.pl

Application procedures & deadlines: Documents listed at http://www.bwm.pk.edu.pl/Application_Procedure_for_MSc_studies_in_Eng.pdf
are to be submitted by **31 May** via e-mail to Ms. Kamila Rościszewska at kamir@pk.edu.pl

Short description of speciality

Production engineering of mass transit vehicles

Speciality **Production Engineering of Mass Transit Vehicles** educates in range:

- production of mass transit vehicle with using the newest techniques of designing and the management of their exploitation;
- functional and structural analysis of the mass transit vehicles;
- opinion and the choice of technical economic parameters of mass transit vehicles;
- logistics and the marketing of mass transit vehicles;
- analysis of efficiency of production and the renowal of mass transit vehicles;

The possible places of working:

- designoffices and the production centres of mass transportation facilities;
- companies of mass transportation, in this municipal;
- centres of renovation of technical transportation;
- logistic and forwarding structures of multimodal transportation;
- scientific and industrial research centres.

The basic lectures of this speciality are:

- Modular design of mass transit vehicles;
- Manufacturing and renewal of mass transit vehicles;
- Computer-aided methods in transport facilities design;
- Technical documentation of manufacturing and exploitation of transport facilities;
- Marketing of mass transit vehicles.

Operation and Management in Transport

The Speciality 'Operation and Management in Transport' is a prospective speciality, the only one in the field of Transport, which gives the opportunity to learn modern methods of business management and the fundamentals of marketing, logistics and operation of vehicles. Students become familiar with the methods of the computer-aided process of operation, organization and functioning of the service and repair units of means of transport.

They learn the rules of use of process monitoring and reliability components, motor vehicles, rolling stock, aircraft and transport and material handling. Transport Operation and Management is the only perspective speciality in the Transport field of study, which gives the opportunity to learn modern methods of business management and the fundamentals of marketing, logistics and maintenance of means of transport.

During the study, students acquire the necessary knowledge of the reliability monitoring as well as wear processes of machines and vehicles. They learn the methods and means of forecasting research, design and use of databases and computer-aided systems and can use a computerized means of communication and methods for modeling logistic processes.

The program of undergraduate studies includes the following items: Means of Transport Design, Vehicle Dynamics – Basic Problems, Economics of Technical Operation of Means of Transport, Means of Transport Maintenance and Operation, Operation Tests of Means of Transport, Computer-aided Operation, Transport Management Computer Systems, Domestic and International Forwarding, Competition Strategy in Transport.

The postgraduate studies include: Mass Transport Vehicles, Wear Processes in Means of Transport, Drive and Braking of Means of Transport, Energy Consumption of Means of Transport, Information Systems in Operation, Organization and Technology of Multimodal Transport, Dangerous Goods Transportation, Econometric Models in Transport, Expert Systems in Transport Management, Logistic Systems in Transport, as well as facultative courses including: Modelling of Vehicle Dynamic Assemblies, Ride Comfort of Means of Transport, Certification, Diagnostics and Technical Expert Opinions, Modelling in Reliability and Technical Diagnostics, Formal and Institutional Issues in Transport, Marketing of Transport Services.

Graduates from the field Operation and Management in Transport acquire the necessary knowledge and skills in organization, management and operation of modern means of transport. Furthermore, they acquire skills to shape the public transport systems in large urban areas, as well as multi-modal cargo transport systems.

Logistics and Spedition

„Logistics and Spedition" specialization is addressed to students who are looking for modernity and have aspirations to work as managers and supervisors with the particular reference to logistics and spedition section. This sector is a criticality section of every economy and it is subject to continuous dynamic development, which creates new workplaces for professional engineers. The basic assumption considered in creating curriculum of this specialization is the versatility of the substantial content of particular classes.

The curriculum of this specialization meets the TSL (Transport, Spedition, Logistics) requirements on the national and international market. In the course of the studies, students obtain knowledge including modern transport and transshipment technologies, logistics management in urban agglomerations and transport-spedition companies as well as planning and research of the effectiveness of logistics process.

Graduates after completing this specialization are able to design and deploy logistics network and logistics services and manage the business of Transport-Logistics-Spedition. They are experts in organizing transportation and logistics and have the skills of a plenty other areas related to the processes in logistics companies. Students get knowledge and skills necessary to control the flow of information, human and material resources in urban areas, optimize logistics costs and the operation of the technical means used in logistic systems, with particular reference to intermodal transport.

Subject conducted included in specialization:

I degree

1. Transport and transshipment technologies in logistics systems.
2. Commodities
3. Urban logistics and ecologistics
4. National and international spedition
5. Supply chain management
6. Designing and research of effectiveness of logistics systems
7. Optimization and planning methods in logistics
8. Operation in logistic systems
9. Computer aided logistics
10. Marketing and the quality of the logistics services.

II degree

1. Transport logistics
2. Logistics systems
3. Logistics management
4. Design and optimization of logistics networks
5. Supply chain management tools
6. Econometric models in logistics
7. Information to assist in logistics and spedition
8. Technology of spedition
9. Formal and institutional issues in spedition

Selectable subjects:

1. Reverse logistics
2. Inventory and warehousing logistics systems
3. Logistics market
4. International Logistics
5. Standardization and quality management in logistics
6. Logistics centers in supply chains

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COURSE TITLE: **HEAT AND POWER PLANTS**

Institute/Division:	Department of Power Technology / Faculty of Mechanical Engineering
Erasmus subject code:	06.1
Number of contact hours:	30
Course duration:	1 semester
ETCS credits:	5
Course description:	Steam power plants, Rankine cycle analysis, combined heat and power, Brayton cycle, gas turbines, gas and oil fired combined cycle plants, internal combustion engines, hydraulic turbines, supercritical advanced fossil fuel power systems, energy storage, nuclear power, nuclear fusion, solar thermal energy conversion, wind energy conversion,
Literature:	F. Kreith, The CRC Handbook of Mechanical Engineering, CRC 1998. R. Kehlhofer et al. Combined – Cycle Gas & Steam Turbine Power Plants, Tulsa, Penn Well Co.,2009 M. P. Boyce, Handbook for Cogeneration and Combined Cycle Power Plants, ASME, New York, 2004
Course type:	Lectures, classes
Assessment method:	Exam
Prerequisites:	Mathematics, Thermodynamics, Heat Transfer
Primary target group:	2nd year Msc in Mechanical Engineering
Lecturer:	Jan Taler, PhD, DSc, Prof.
Contact person:	Jan Taler, PhD, DSc, Prof, phone #: +48 126283560 e-mail: taler@mech.pk.edu.pl
Deadline for application:	May 31

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COURSE TITLE:	**HEAT TRANSFER**
Institute/Division:	Department of Power Technology/ Faculty of Mechanical Engineering
Erasmus subject code:	06.1
Number of contact hours:	60
Course duration:	1 semester
ETCS credits:	5
Course description:	Steady-state and transient heat conduction, direct and inverse problems, natural and forced convection, convection with phase changes, thermal radiation, combustion chambers, heat exchangers, heat transfer analysis and design problems
Literature:	F. P. Incropera et. al. Fundamentals of Heat and Mass Transfer, John Wiley & Sons 2007. J. Taler, P. Duda, Solving Direct and Inverse Heat Conduction Problems, Springer, Berlin Heidelberg 2006. G.F.Hewitt et al. Process Heat Transfer, CRC, Boca-Raton, 1994 Y. A. Çengel et al Fundamentals of Thermal Fluid Sciences, McGraw-Hill, Hoboken, 2004
Course type:	Lectures, classes, laboratory
Assessment method:	Exam
Prerequisites:	Mathematics, Thermodynamics
Primary target group:	1st year Msc in Mechanical Engineering
Lecturer:	Jan Taler, PhD, DSc, Prof.
Contact person:	Jan Taler, PhD, DSc, Prof, phone #: +48 126283560 e-mail: taler@mech.pk.edu.pl
Deadline for application:	May 31

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COURSE TITLE:	**POWER TURBINES**
Institute/Division:	Department of Power Technology / Faculty of Mechanical Engineering
Erasmus subject code:	06.1
Number of contact hours:	45
Course duration:	1 semester
ETCS credits:	4
Course description:	Steam turbine – Rankine cycle. Turbine characteristics. principle of operation and design. Impulse and reaction steam turbines. Multistage turbine. Governors and Control Systems. Gas turbine, types of gas turbines. Theory of operation.
Literature:	Heinz P. Bloch, Murari P. Singh, Steam Turbines, Edition Number 2, McGraw-Hill, 2009. John R. Allen, Joseph A. Bursley, Heat Engines - Steam, Gas, Steam Turbines and Their Auxiliaries. Merchant Books, 2008.
Course type:	Lectures, classes, laboratory
Assessment method:	Final test
Prerequisites:	Mathematics, Thermodynamics, Heat Transfer
Primary target group:	2nd year Msc in Mechanical Engineering
Lecturer:	Pawel Oclon MSc
Contact person:	**Pawel Oclon**, MSc, phone #: +48 126283773 e-mail: poclon@mech.pk.edu.pl
Deadline for application:	May 31

COURSE TITLE: **Hydraulic and Wind Turbines**

Institute/Division:	Department of Thermal Power Engineering / Faculty of Mechanical Engineering
Erasmus subject code:	06.1
Number of contact hours:	60
Course duration:	1 semester
ETCS credits:	5
Course description:	Turbine principles; water turbines; Pelton Turbine: characteristic, velocity triangle, turbine power, maximum turbine efficiency; Reaction turbines: characteristic, turbine power, Euler's turbine formula, velocity triangle, turbine efficiency; water turbine selection for different condition; nature of wind and wind energy, drag and lift force, actuator disc concept, power coefficient, Betz limit, wind turbine classes, Weibull distribution, turbine selection and energy production
Literature:	Cengel Y. A., Cimbala J. M. “Fluid Mechanics Fundamentals and Application”, Mc Graw-Hill Da Rosa A. „Fundamentals of Renewable Energy Processes” Elsevier, New York 2009 Manwell J. F., McGowan J. G., Rogers A.L. “Wind Energy Explained; Theory, Design and Application”, John Wiley and Sons Potter M. C., Wiggert D. C. „Mechanics of Fluids“, Cengage Learning, 2010 Zoeb H., Zulkifly A., Zainal A. „Basic Fluid Mechanics and Hydraulic Machines” CRC Press, Taylor & Francis Group, New York 2007Heinz P. Bloch, Murari P. Singh,
Course type:	Lectures, classes
Assessment method:	Final test (exam)
Prerequisites:	Fluid Mechanics
Primary target group:	2nd year MSc in Mechanical Engineering 3rd year BSc in Power Engineering

Lecturer: Piotr Wais, PhD Eng

Contact person: Piotr Wais, PhD Eng phone #: +48 126283660
e-mail: wais@mech.pk.edu.pl

Deadline for application: May 31

COURSE TITLE: NUMERICAL METHODS

Institute/Division: Department of Power Technology / Faculty of Mechanical Engineering

Erasmus subject code: 06.1

Number of contact hours: 60

Course duration: 1 semester

ETCS credits: 6

Course description: Computer numbers, error analysis, conditioning, stability of algorithms, nonlinear equations in one variable, direct and iterative methods for solving systems of linear equations, linear and nonlinear approximation, polynomial interpolation, initial value problems for ordinary differential equations, Finite Difference Method, inverse methods

Literature: J. Taler, P. Duda, Solving Direct and Inverse Heat Conduction Problems, Springer, Berlin Heidelberg 2006.
G.Engeln-Mullges, F. Uhling, Numerical Algorithms with Fortran, Springer, Berlin Heidelberg 1996

Course type: Lectures, classes, computer laboratory

Assessment method: Projects and exam

Prerequisites: Mathematics

Primary target group: 1st year Msc in Mechanical Engineering

Lecturer: Piotr Duda, PhD, DSc.

Contact person: Piotr Duda, PhD, DSc, phone #: +48 126283560
e-mail: pduda@mech.pk.edu.pl

Deadline for application: May 31

COURSE TITLE: **ENVIRONMENT PROTECTION**

Institute/Division: Department of Power Technology/ Faculty of Mechanical Engineering

Erasmus subject code: 06.1

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 2

Course description: Air Pollution, Green House Effect, Particle Control and Removing (Dust Chambers, Scrubbers, Spray Dryer Absorbers, ESP, Bag Filters), Flue Gas Desulphurization, Flue Gas Denitrification, Combustion Optimization, Carbon Dioxide Capture and Sequestration, Waste Water Treatment, Soil and Groundwater Remediation

Literature:
Kitto J.B., Stultz S.T., Steam - Its Generation and Use, Babcock & Wilcox 41Ed., Barberton 2005.
Introduction of Japanese Advanced Environmental Equipment, Japan Society of Industrial Machinery Manufacturers 2001
Kurita Handbook of Water Treatment
Marini L., Gological Sequestration of Carbon Dioxide, Elsevier 2006
Gerard D., Wilson E., Wilson L. Ed., Carbon Capture and Sequestration Integrating Technology, Monitoring, Regulation, Wiley-Blackwell 2007
Lunt R. R., Cunic J. D., Profiles In Flue Gas Desulfurization, Wiley 2000

Course type: Lectures

Assessment method: Final test

Prerequisites: Fluid Mechanics

Primary target group: 1st year Msc in Mechanical Engineering

Lecturer: Tomasz Sobota, Ph.D.

Contact person:	Tomasz Sobota. Ph.D., phone #: +48 126283558 e-mail: tsobota@mech.pk.edu.pl
Deadline for application:	May 31

COURSE TITLE	**ALTERNATIVE POWER SOURCES**
Institute/Division	Institute of Automobiles and Internal Combustion Engines / Faculty of Mechanical Engineering
Erasmus subject code	06.1
Number of contact hours	15
Course duration	1 semester
ETCS credits	2
Course description	Exploring of future energy sources. Directions of future clean coal technologies with coal gasification. Review of alternative energy sources in powering of vehicles. Renewable and fossil fuels in future power sources in a regard of decreasing of CO_2 and other substances. Characteristics of alternative fuels (natural gas, hydrogen, biofuels) in internal combustion engines. Non-conventional power sources: electric drive systems with control devices, present hybrid drive systems and their development in automotive industry, different kinds of fuel cells and their perspective in a future transportation and solar cells as a source of free energy. Fuelling of engines by CNG, LNG, LPG and hydrogen. The wind and sea water energy systems in different world areas. Determination of the future clean and friendly for environment power sources
Literature	Web-sites Advanced Vehicle System, Capstone, Chattanooga,2002 Alternative Fuel Data Center, http:/www.afdc.doe.gov Anderson H.K., Electric and Hybrid Vehicles: A 25-year Forecast. Automotive Engineering, No 2, 1996 Braess H., Hydrogen-The Fuel for Future Powertrain Technologies, BMW Group, Munich, 2001 Carracher P., Realistic Application of CNG Fuel in Commercial Road Vehicles, FISITA World Automotive Congress, Paris, 1998
Course type	Lectures, classes
Assessment	Final test
Prerequisites	Mechanical Engineering and Power Engineering Systems

Primary target group	3rd year Mechanical Engineering and Power Engineering students
Lecturer	DSc PhD Eng. Wladyslaw Mitianiec, Professor of Cracow University of Technology
Contact person	DSc PhD Eng. Wladyslaw Mitianiec, Prof. CUT; phone #: +48 12 628 3692, e-mail: wmitanie@usk.pk.edu.pl
Deadline for application	June 30 or November 30

COURSE TITLE:	**COMBUSTION ENGINES**
Institute/Division:	Combustion Engines Chair / Institute of Vehicles and Combustion Engines / Mechanical Faculty
Erasmus subject code:	06.1
Number of contact hours:	30
Course duration:	1 semester
ETCS credits:	3
Course description:	LECTURES: Combustion engines theory, piston engines construction, combustion processes in combustion engines (SI and CI). Charging of combustion engines. Alternative fuels. Fuel supply and equipment of combustion engines. Technology and exploitation of combustion engines. Ecology of combustion engines, exhaust gas emission measurements. Electronic control systems of combustion engines. LABORATORY CLASSES: Characteristics of piston engine (speed-, load-, regulation-, universal-). Indicating of SI and CI engine. Visualization of combustion process in CI engine. Measurements of exhaust gas emission of the piston engine fuelled with alternative fuels.
Literature:	Heywood, John B.:“Internal Combustion Engine Fundamentals, McGraw-Hill, Inc. 1988. Martyr A. J., Plint M. A.: Engine Testing, Butterworth-Heinemann, 2007. ISBN 13: 978-0-7506-8439-2

Course type: Lectures, laboratory classes

Assessment method: Final test

Prerequisites: Theoretical mechanics, thermodynamics

Primary target group: 3 rd year Automotive Engineering (lectures only) undergraduate studies (4 years) leading to the degree of equivalent to an BSc, or 1st year Automotive Engineering (full course) of graduate studies (1,5 year) leading to the degree of equivalent to a MSc

Lecturer: Jerzy Dutczak, DEng

Contact person: Jerzy Dutczak, DEng,; phone #: +48 12 6283534
e-mail: jdutczak@usk.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **FUEL FEEDING SYSTEMS FOR AN INTERNAL COMBUSTION ENGINES**

Institute/Division: Institute of Automobiles and Internal Combustion Engines / Faculty of Mechanical Engineering

Erasmus subject code: 06.1

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: LECTURES: Functional analysis of the fuel feeding system in a combustion system of reciprocating engines. The process of air-fuel mixture formation. The selected issues of mass and energy exchange. Problems of charge transport in the engine inlet duct, inequality of the charge distribution in multi cylinder engine. Carburetors' feeding systems - the required characteristics. Injection fuel systems of SI engines - properties of injection systems. Control algorithms, operating characteristics. Systems of direct fuel injection of SI engines. Systems of fuel injection of CI engines - properties of injection systems. Control algorithms - the required characteristics of fuel dosage. Alternative fuel engines - flexible fuel systems. LABORATORY: Systems and devices for testing of feedings components system. Injection pump test bed characteristics of fuel dosage. The execution of the fuel injection characteristics. Operating characteristics of SI engine on a bio-fuel feeding condition. Visualization of air-fuel mixture formation process for a direct fuel injection. Test of the engine CPU to fuel dosage control.

Literature: H. Schwarz et al, 1999,"Gasoline-engine management", Robert Bosch GmbH, Automotive Handbook, 1986, 2nd Edition, Bosch, J.C. Guibet, 1999, "Fuels and Engines" , John B. Heywood, 1988,"Internal Combustion Engine Fundamentals",

Course type: Lectures (blended learning – 9 hours as online e–learning Moodle platform course), classes and test bed laboratory,

Assessment method: Final test

Prerequisites: Thermodynamic processes and mechanics of internal combustion engines

Primary target group: 3rd year Automotive Engineering (lectures only) undergraduate studies (4 years) leading to the degree of equivalent to an BSc, or 1st year Automotive Engineering (full course) of graduate studies (1,5 year) leading to the degree of equivalent to a MSc

Lecturer: Wojciech MAREK, DSc., DEng,

Contact person: Wojciech MAREK, phone#: +48 12 6283682
e-mail: wmarek@pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE: **ECOLOGY OF COMBUSTION ENGINES**

Institute/Division: Combustion Engines Chair / Institute of Vehicles and Combustion Engines / Mechanical Faculty

Erasmus subject code: 06.1

Number of contact hours: 30

Course duration: 1 semester

ETCS credits: 3

Course description: LECTURES: Meaning of vehicles in the present world in aspect of their effect on natural environment. Mechanism of SI and CI engines exhaust gas toxic components formulation. Profile of particular exhaust gas toxic components. Photochemical smog. The ways of toxic components emission decrease: catalytic reactors, particles filters. Emission limits and test methods of engines exhaust toxic components: homologation limits, periodical technical tests limits. Noise, vibration and heat emitted by vehicles. Vehicles parts wear, exploitation materials, recycling. Vehicle exploitation methods in aspect of environment influence.
LABORATORY CLASSES: Measurement of exhaust gas toxic components concentration according to vehicle periodical tests requirements. Measurement of exhaust gas toxic components concentration before and after the catalytic converter (including DeNOx reactor) by means of the analyzers NDIR, FID and CLD. Measurement of exhaust gas emission during engine warming up phase.

Literature: Bielaczyc P., Merkisz J., Pielecha J., Stan cieplny silnika spalinowego a emisja związków szkodliwych, Wydawnictwo Politechniki Poznańskiej, Poznań 2001.
Merkisz J.: Ekologiczne problemy silników spalinowych, Wydawnictwo Politechniki Poznańskiej, Poznań 1998.

Course type: Lectures, laboratory classes

Assessment method: Final test

Prerequisites: Internal combustion engines theory

Primary target group: 3 rd year Automotive Engineering (lectures only) undergraduate studies (4 years) leading to the degree of equivalent to an BSc, or 1st year Automotive Engineering (full course) of graduate studies (1,5 year) leading to the degree of equivalent to a MSc

Lecturer: Marek Brzeżański, DSc., DEng

Contact person: Marek Brzeżański, DSc., DEng,; phone #: +48 12 6283544
e-mail: mbrzez@usk.pk.edu.pl

Deadline for application: June 30 or November 30

COURSE TITLE **CLEAN COMBUSTION ENGINEERING**

Institute/Division Institute of Automobiles and Internal Combustion Engines / Faculty of Mechanical Engineering

Erasmus subject code 06.1

Number of contact hours 30

Course duration 1 semester

ETCS credits 3

Course description Theory of combustion process. Processes of ignition, self-ignition and detonation. Theory of flame – flow and thermal parameters. Combustion of gaseous fuels, types of gas combustion. Combustion rates of gaseous fuels and their dependence on thermal conditions. Furnaces and gaseous burners. Combustion process of liquid fuels, injection of liquid fuels, evaporation, oil burners. Combustion of solid fuels particularly of coal. Speed and intensity of coal combustion in layer and in mechanical stokers. Combustion of coal dust, combustion of solid fuels in fluid layer. Fluid boiler systems. Methods of coal cleaning before combustion and methods of reduction of sulphur in furnaces. Combustion technologies in order to reduce nitrogen oxygen by temperature control. Ecological aspects of fuels combustion and exhaust gas emissions. Low emission technologies in power engineering. Design of new low emission coal combustion systems in industry with steam and gas turbines. Coal gasification technology. Experimental test on reduction of exhaust emission in internal combustion engines by changing the combustion process and by external devices. Measurements of flame parameters at combustion of different fuels. Experiments with reduction of exhaust emission of hydrocarbons, nitrogen oxides, soot and others. Calculations of combustion processes of different fuels, burners, furnaces, combustion rates and others.

Literature

Chigier W.A.,Energy, Combustion and Environment, New York, McGraw Hill,1981;
Jarosiński J., Technology of clean combustion (in polish), WNT Warsaw, 1996
Jarosiński Jozef, Combustion Phenomena: Selected Mechanisms of Flame Formation, Propagation and Extinction, 2008
Carvalhoc, Combustion Technologies for Clean Environment, V.1, CRC, 1985

	Smoot L. Douglas, Coal Combustion and Gasification, Springer, 1985
Course type	Lectures, classes and experimental laboratories
Assessment	Final test
Prerequisites	Combustion Chemistry and Power Engineering Systems
Primary target group	3rd year Mechanical Engineering and Power Engineering students
Lecturer	DSc PhD Eng. Wladyslaw Mitianiec, Professor of Cracow University of Technology
Contact person	DSc PhD Eng. Wladyslaw Mitianiec, Prof. CUT; phone #: +48 12 628 3692, e-mail: wmitanie@usk.pk.edu.pl
Deadline for application	June 30 or November 30

COURSE TITLE:	**TURBINE ENGINES**
Institute/Division:	Combustion Engines Chair / Institute of Vehicles and Combustion Engines / Mechanical Faculty
Erasmus subject code:	06.1
Number of contact hours:	30
Course duration:	1 semester
ETCS credits:	3
Course description:	LECTURES: Flow through a variable cross section channel, sound velocity, critical flow. Nozzle and diffuser, subsonic and supersonic flow, Laval nozzle. Theoretical basics of turbine engines work, thermal cycle of turbine engine. Classification of turbine engines: turboshaft, turboprop, turbojet, turbofan. Construction of turbine engines: air intake systems, intake air filtration systems, principle of operation of the stage of flow machine, compressors types, characteristics of compressors, compressor stall and counteraction methods, kinds of

combustion chambers, combustion processes in combustion engines, fuel supply systems, principle of work and kinds of turbines, outlet systems, afterburners, thrust reversers. Lubrication systems and equipment of turbine engines. Review of flow engines construction on the basis of exhibits of Polish Aviation Museum in Cracow and own test stands with GTD-350 and AI-9 engines.

Literature: Sforza P.: Theory of Aerospace Propulsion, Butterworth-Heinemann 2011, ISBN 13: 978-1-85617-912-6.

Cheda W., Malski M.: Techniczny poradnik lotniczy – Silniki, WKŁ Warszawa 1984.

Course type: Lectures

Assessment method: Final test

Prerequisites: Thermodynamic processes and mechanics of internal combustion engines

Primary target group: 3rd year Automotive Engineering (lectures only) undergraduate studies (4 years) leading to the degree of equivalent to an BSc, or 1st year Automotive Engineering (full course) of graduate studies (1,5 year) leading to the degree of equivalent to a MSc

Lecturer: Jerzy Dutczak, DEng

Contact person: Jerzy Dutczak, DEng,; phone #: +48 12 6283534
e-mail: jdutczak@usk.pk.edu.pl

Deadline for application: June 30 or November 30

List of courses offered
by Faculty of Physics, Mathematics and Computer Science

Winter semester

- Parallel and Distributed Programming
- Computer Systems Administration
- Elements of Artificial Intelligence
- Cryptography
- Software Engineering
- Information Systems in Management
- Object-Oriented programming
- Computer graphics

Summer semester

- High Performance Computing
- C++ Programming
- Neural Networks
- Discrete mathematics
- Approximation Theory with Applications
- Numerical Analysis
- Computer Image Processing
- Matlab Programming
- Mobile technologies and programming

COURSE TITLE: **Parallel and Distributed Programming**

Institute/Division: F-3, Institute of Computer Science

Course code: F34-PDP

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: Operating system's foundations: processes, threads, sockets. Parallel programming models - Flynn's taxonomy, PRAM, data parallel programming. Programming shared memory systems: data dependencies and OpenMP specification. Programming distributed memory systems: message passing paradigm, MPI specification, group communication. Parallel speed up and efficiency. Distributed programming - RPC, CORBA. Service oriented architecture and Web Services. Grid architecture

Literature:

G. Coulouris et al., "Distributed Systems. Concepts and Design" (4th ed.), Addison Wesley, 2005

A. S. Tanenbaum, "Distributed Systems. Principles and Paradigms" (2nd ed.), Prentice Hall 2002

Grama A. et al., „Introduction to Parallel Computing" (2nd ed.), Addison-Wesley, 2003

Course type: Lectures and laboratories

Assessment method: Attendance, evaluation of small projects, exam

Prerequisites: programming languages, operating systems

Primary target group: 3-th – 4-th year computer science students

Lecturer: Krzysztof Banaś, PhD, DSc

Contact person: Krzysztof Banaś, PhD, DSc
kbanas@pk.edu.pl

Deadline for application: 15th of September

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **High Performance Computing**

Institute/Division: F-3, Institute of Computer Science

Course code: F34-HPC

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: Architectures for high performance computing - processors, parallel systems. Classical and parallel optimization. Parallel algorithms for sorting, linear algebra and PDE simulation, GPGPU computations

Literature:
L. Ridgeway Scott, Terry Clark, Babak Bagheri, „Scientific Parallel Computing", Princeton University Press, 2005
Kevin Dowd, Charles Severance, "High Performance Computing", 2nd ed., O'Reilly, 1998.

Course type: Lectures and laboratory classes

Assessment method: Attendance, evaluation of small projects, exam

Prerequisites: programming languages, parallel programming

Primary target group: 3-rd – 4-th year computer science students

Lecturer: Krzysztof Banaś, PhD, DSc

Contact person: Krzysztof Banaś, PhD, DSc
kbanas@pk.edu.pl

Deadline for application: 15th of January

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **C++ Programming**

Institute/Division: Institute of Computer Science

Erasmus subject code: F32-C++P

Number of contact hours: 45 hours

Course duration: 1 semester

ETCS credits: 6

Course description: The course covers the basics and also more advanced topics of C++ programming language. No prior knowledge about C++ is required. The students learn about the structure of the projects created in C++, the organization of the source files, the compilation and linking processes by using different tools. The course follows the standard C++ without focusing on tools of any specific vendor, however Microsoft Visual Studio is used be students during the laboratories. The students learn the basics of C++ such as loops, flow control, conditional statements, arrays, pointers, etc.. More advanced topics cover memory management, object oriented programming, operator overloading, I/O operations and an introduction to generic programming and Standard Template Library (STL). After the theoretical introduction during the lecture, the students analyse the example programs during the laboratories. They are also required to prepare several projects with an increasing level of difficulty.

Literature:
1. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Professional; 3 Edition, 1997
2. Bruce Eckel, Thinking in C++: Introduction to Standard C++, Prentice Hall; 2 Edition, 2000
3. Matthew H. Austern, Generic Programming and the STL: Using and Extending the C++ Standard Template Library, Addison-Wesley Professional Computing Series, 1999

Course type: Lectures and computer laboratory

Assessment method: Project and final test

Prerequisites: Basic programming knowledge in any language, basic computer skills

Primary target group: 3rd year Information Sciences / Physics students

Lecturer: Michał Bereta, PhD Eng.

Contact person: Michał Bereta, PhD Eng., phone (+48 12) 628-21-06
e-mail: beretam@torus.uck.pk.edu.pl

Deadline for application: 15th of January

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **Computer Systems Administration**

Institute/Division: F-3, Institute of Computer Science

Course code: F31-CSA

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: All aspects of configuring and managing an Internet-based server and client with the Linux operating system. Software configuration, installation, upkeep and management; user management, security and data integrity.

Literature: All notes and references will be given electronically to all students during the lectures.

Course type: Lectures and exercises

Assessment method: A few tests (each one will be announced two weeks in advance).

Prerequisites: Unix/Linux operating system and with computer networks.

Primary target group: 3-th – 4-th year computer science students

Lecturer: Barbara Borowik, PhD

Contact person: Barbara Borowik, PhD
bborowik@pk.edu.pl

Deadline for application: 15th of September

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **Elements of Artificial Intelligence**

Institute/Division: F-3, Institute of Computer Science

Course code: F32-EAI

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: The module introduces AI techniques for optimization, search, reasoning about actions, representing and reasoning with uncertainty and AI planning. The search techniques are applicable to problems in AI and optimisation and include: heuristic search, hill climbing, genetic algorithms, simulated annealing, tabu search, local beam search and SAT. The planning techniques are applicable to complex task planning and planning for mobile robots. Topics covered include: approaches to reasoning about actions and searching for plans efficiently, design and fine-tunning of heuristics.

Literature: Basic literature on the subject of artificial intelligence

Course type:	Lectures and laboratories
Assessment method:	Attendance, evaluation of small projects, exam
Prerequisites:	programming languages
Primary target group:	3-th – 4-th year computer science students
Lecturer:	Prof. Andrzej Bargieła
Contact person:	Prof. Andrzej Bargieła
Deadline for application:	15th of September
Remarks:	The course will start for at least 5 foreign students

COURSE TITLE:	**Neural Networks**
Institute/Division:	F-3, Institute of Computer Science
Course code:	F32-NN
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	45 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	General description of the neural networks. Relations between classical algorithms and neural methods of problem solving. Artificial neural network and human brain. Structure of single artificial neuron. Architectures of neural networks and dependence between complexity

of the solved problem and structural complexity of the network. Methods of neural network learning and training. Back propagation and other methods of learning. Self learning of the networks and problem of self-organization. Networks with feedback. Possibilities and limitations of many types of networks.

Literature: Basic literature on the subject

Course type: Lectures and laboratories

Assessment method: Attendance, evaluation of small projects, exam

Prerequisites: Programming languages, base of artificial intelligence

Primary target group: 4-th year computer science students

Lecturer: Agnieszka Krok, PhD

Contact person: Agnieszka Krok, PhD

Deadline for application: 15th of January

Remarks: The course will start for at least 5 foreign students

COURSE TITLE:	**Discrete Mathematics**
Institute/Division:	F-3, Institute of Computer Modelling
Course code:	F31-DM
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	45 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	Graphs. Basic definitions. Eulerian graph, Eulerian circuit, Euler theorem. Fleury's algorithm. Hamiltonian graph, Hamiltonian cycle. Degree of a vertex. Dirac theorem. Directed graphs. Weighted graphs. Dijkstra's algorithm. Trees. Rooted tree, spanning tree, minimum spanning tree. Kruskal's algorithm, Prim's algorithm. Sorting algorithms. Networks and critical paths. Coloring of a graph. Groups of permutations.
Literature:	C.A. Ross, C.R.B. Wright, Discrete Mathematics, Prentice Hall, Englewood Cliffs, N.J. 1988. N.L. Biggs Discrete mathematics, Oxford Univ. Press, Oxford, 2002. E.G. Goodaire, M.M. Parmenter, Discrete Mathematics with Graph Theory, Prentice Hall, Engl. Cliffs, N.J. 2002.
Course type:	Lectures and exercises
Assessment method:	Attendance, ability of solving of simple exercises, exam
Prerequisites:	None
Primary target group:	1-st – 2-nd year computer science students
Lecturer:	Andrzej Karafiat, PhD, DSc
Contact person:	Andrzej Karafiat, PhD, DSc akaraf@pk.edu.pl
Deadline for application:	15th of January
Remarks:	The course will start for at least 5 foreign students

COURSE TITLE:	**Cryptography**
Institute/Division:	F-3, Institute of Computer Modelling
Course code:	F31-C
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	45 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	Integers. Divisibility of integers. Prime numbers. Euclidean algorithm. Factoring into primes. Congruences. Operations modulo. Fermat's Little Theorem. The Chinese Remainder Theorem. Euler function. Fast exponentiation. Finite groups and fields. Element orders. Encryption schemes. Symmetric cryptosystems: substitution ciphers, block ciphers, permutation ciphers. System DES. Public – Key systems: RSA, discrete logarithm. Hash functions. Digital signatures.
Literature:	J.A.Buchmann, Introduction to cryptography, Springer, New York 2000. N.Ferguson, B.Schneier, Practical cryptography, Wiley & Sons, New York 2003. N.Koblitz, A course in number theory and cryptography, Springer, Berlin 1998.
Course type:	Lectures and exercises
Assessment method:	Attendance, ability of solving of simple exercises, exam
Prerequisites:	General algebra
Primary target group:	3-th – 4-th year computer science students
Lecturer:	Agnieszka Krok, PhD
Contact person:	Agnieszka Krok, PhD akaraf@pk.edu.pl
Deadline for application:	15th of September

Remarks: The course will start for at least 5 foreign students

COURSE TITLE:	**Approximation Theory with Applications**
Institute/Division:	F-3, Institute of Computer Science
Course code:	F3_ATA
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	30 hours/15 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	Foundation of interpolation and approximation theory, interpolated splines, Bezier curves, Bezier surfaces, theory of B-spline functions, B-spline functions applications, B-spline curves, B-spline surfaces, Coons curves and surfaces, periodic splines, multi-knot splines, derivatives and integrals of B-spline functions.
Literature:	D. Kincaid, W. Cheney: Numerical Analysis. **G.** Dahlquist, K.W. Morton, B. Parlett, J. Walsh: Curve and Surface Fitting with Splines, Clarendon Press, Oxford, 1995. Computer Graphics and Pattern Recognition / Theo Pavlidis .
Course type:	Lectures and laboratories
Assessment method:	Attendance, evaluation of small projects, exam
Prerequisites:	programming languages, fundamentals of higher mathematics and numerical methods
Primary target group:	3-th – 4-th year computer science students
Lecturer:	Jan Kucwaj, PhD
Contact person:	Jan Kucwaj, PhD jkucwaj@pk.edu.pl
Deadline for application:	15th of January
Remarks:	The course will start for at least 5 foreign students

COURSE TITLE: **Numerical Analysis**

Institute/Division: F-3, Institute of Computer Science

Course code: F3_NA

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: Error analysis, order of convergence, solution to linear system of equations, Gauss method, Gauss-Jordan method, Banachiewicz-Cholesky method, inverse of the matrix, iterative methods, Interpolation, approximation, least squares method, numerical differentiation, numerical integration, Newton-Cotes formulas, Gauss integration, solution to nonlinear system of equations, eigenvalue problem.

Literature: D. Kincaid, W. Cheney: Numerical Analysis.

Course type: Lectures and laboratories

Assessment method: Attendance, evaluation of small projects, exam

Prerequisites: programming languages, computer networks

Primary target group: 2-rd year computer science students

Lecturer: Jan Kucwaj, PhD,

Contact person: Jan Kucwaj, PhD,
jkucwaj@pk.edu.pl

Deadline for application: 15th of January

Remarks: The course will start for at least 5 foreign students

COURSE TITLE:	**Computer Image Processing**
Institute/Division:	F-3, Institute of Computer Modelling
Course code:	F34-CIP
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	45 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	Image acquisition, digital colour models, colour bit depth, raster image standards, geometrical and arithmetical transformations, histogram and operations, image binarization, segmentation, logical operations, image filtering, morphological operations, skeletonization, image compression, face recognition, fractal graphics
Literature:	Basic literature on the image processing and Matlab
Course type:	Lectures and laboratories
Assessment method:	Attendance, tests, exam
Prerequisites:	Fundamentals of programming, Matlab
Primary target group:	4-th year computer science students
Lecturer:	Agnieszka Ozimek, PhD, eng arch
Contact person:	Agnieszka Ozimek, PhD, eng arch aozimek@pk.edu.pl
Deadline for application:	15th of January
Remarks:	Laboratories: Matlab Image processing Toolbox. The course will start for at least 5 foreign students

COURSE TITLE:	**Software Engineering**
Institute/Division:	F-3, Institute of Computer Science
Course code:	F33-SE
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	45 hours
Course duration:	1 semester
ECTS credits:	6
Course description:	All aspects of software production process thorough treatment of the development lifecycle, modeling languages (UML), engineering tools, project planning and process management. The course emphasizes object-oriented modeling and programming, explains the use of components and business object and highlights application of architectural design and refactoring.
Literature:	D.Hamlet, J.Maybee, *The Engineering of Software– Technical Foundations for the Individual*, Addison Wesley Longman Inc. 2001, L.Maciaszek, B.Lee Liong, *Practical Software Engineering, A Case Study Approach*, Pearson Education Limited 2005
Course type:	Lectures and laboratories
Assessment method:	A few tests (each one will be announced two weeks in advance), ability of solving of simple exercises, exam.
Prerequisites:	Programming languages, algorithms and data structures, data bases.
Primary target group:	3-th – 4-th year computer science students
Lecturer:	Marek Stanuszek, PhD, DSc.
Contact person:	Marek Stanuszek, PhD, DSc. marek.stanuszek@pk.edu.pl
Deadline for application:	15^{th} of September

Remarks:	The course will start for at least 5 foreign students

COURSE TITLE:	**Information Systems in Management**
Institute/Division:	F-3, Institute of Computer Modelling
Course code:	F33-ISM
Erasmus subject code:	Informatics, Computer Science
Number of contact hours:	30 hours/ 15 hours
Course duration:	1 semester
ECTS credits:	4
Course description:	Architecture of Information Integrated Management Systems is delivered. The development of Manufacturing Resource Planning (MRP), Enterprise Resource Planning (ERP) as well as Client Resource Management (CRM) systems is considered on the focus of their application for management processes of Small and Middle Enterprises (SME). The concept of evolution of Real-Time Enterprises is analyzed. Integrated Managed Systems e.g. R/3 SAP, IFS, Impuls BPSC are tested and practiced.
Literature:	All notes and references will be given electronically to all students during the lectures.
Course type:	Lectures and laboratories
Assessment method:	A few tests (each one will be announced two weeks in advance), ability of solving of simple exercises in selected system.
Prerequisites:	Base of software engineering, algorithms and data structures, data bases.
Primary target group:	3-th – 4-th year computer science students

Lecturer: Piotr Zabawa, PhD

Contact person: Piotr Zabawa, PhD
pzabawa@pk.edu.pl

Deadline for application: 15th of September

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **Object Oriented Programming**

Institute/Division: F-3, Institute of Computer Science

Course code: F3-OOP

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: basics of object oriented techniques: classes, interfaces, abstract classes, inheritance, encapsulation, implementation hiding; design patterns – definitions and example projects; C# realization of object oriented features; elements of test driven development (TDD) approach to software development

Literature:
1. "Programming C#. Building .NET Applications with C#", Jesse Liberty
2. "Microsoft Visual C# 2010 Step by Step", John Sharp
3. "Head First Design Patterns", Elisabeth Freeman, Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson
4. "Design Patterns in C#", Steven John Metsker
5. "The Object-Oriented Thought Process (3rd Edition)", Matt Weisfeld

Course type: Lectures and laboratories

Assessment method: Attendance, evaluation of small projects, exam

Prerequisites: basics of programming languages (procedural programming, loops, conditional statements etc., other object oriented languages appreciated but not necessary)

Primary target group: 2-th – 4-th year computer science students

Lecturer: Michał Bereta, PhD, Eng.

Contact person: Michał Bereta, PhD, Eng.
mbereta@pk.edu.pl

Deadline for application: 15th of September

Remarks: The course will start for at least 5 foreign students

COURSE TITLE: **MATLAB PROGRAMMING**

Institute/Division: F-3, Institute of Computer Science

Course code: F32-MP

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis and numeric computation.

Course consists: basic syntax and command-line exercises, introduction to programming in MATLAB (read and make code of MATLAB, operators, special values, conditional statements, loop control statements), functions and scripts, matrices and arrays, object-oriented programming, parallel computing by using *Parallel Computing Toolbox*, mathematical function library, functions for two- and three-dimensional data visualization, handle graphics, build graphical user interfaces, creating and simulating a Simulink model.

Literature:

1. MATLAB homepage resources: www.mathworks.com
2. B. Mrozek, Z. Mrozek, MATLAB i Simulink, Poradnik użytkownika (MATLAB and Simulink, 3e: User's Guide – in Polish, for reference only)
3. File examples http://www.mathworks.com/matlabcentral/fileexchange/5061#

Course type: Lectures (20h), laboratories (20h), projects (5h),

Assessment method: Laboratory exercises and projects.

Prerequisites: Any language of programming.

Primary target group: 3-th year students.

Lecturer: Bogumiła MROZEK, PhD,

Contact person: Bogumiła MROZEK, PhD, bmrozek@pk.edu.pl

Deadline for application: 15th of January

Remarks: MATLAB, Simulink and their extensions (toolboxes) are available in computer laboratory. MATLAB extensions will be used during lectures. The course will start for at least 5 foreign students.

COURSE TITLE: **Mobile Technologies and Programming**

Institute/Division: F-3, Institute of Computer Science

Course code: F3-MT

Erasmus subject code: Informatics, Computer Science

Number of contact hours: 45 hours

Course duration: 1 semester

ECTS credits: 6

Course description: The main objective of this course is to provide the basic knowledge and skills on the development of mobile applications based on J2ME and selected BlackBerry programming tools (WebWorks and/or cascades). Also, some basic concepts related to software modelling based on UML were introduced in order to provide the necessary knowledge on abstract design techniques, such class diagrams, use case diagrams, and message sequence charts, to start the design and development of the projects before starting coding. A project-based learning approach for teaching mobile software development has been applied for the lab work. First, the students start to write their first mobile web-based applications with BlackBerry WebWork, and then the individual projects proposed by the students them self are prepared as final projects for the course. The target platform for all final projects is the Android OS.

Literature:

1. https://developer.blackberry.com/
2. http://jquerymobile.com/
3. http://www.mono-project.com/Main_Page
4. http://ofps.oreilly.com/titles/9781449390501/

Assessment method: Laboratory exercises and projects.

Prerequisites: C++ and/or Java programming, basic knowledge of HTML5 and Java Script

Primary target group: 3-th year students.

Lecturer: Joanna Kołodziej, PhD

Contact person: Joanna Kołodziej, PhD, bmrozek@pk.edu.pl

Deadline for application: 15th of January

Remarks: MATLAB, Simulink and their extensions (toolboxes) are available in computer laboratory. MATLAB extensions will be used during lectures. The course will start for at least 5 foreign students.

Faculty of Chemical Engineering and Technology

Syllabus in English

COURSE TITLE:	**Chemical Technology II**
Institute/Division :	Institute of Chemistry and Inorganic Technology Institute of Chemistry and Organic Technology
Course code:	
Type of course:	obligatory
Number of contact hours:	45
Semester of study:	II stage, year I, semester 1
ECTS credits:	3
Course description:	Inorganic chemical technology: Presentation of fertilizers production technologies and rules for its application, sodium phosphates production technologies and its application. Discussion on advantages and disadvantages of basic inorganic technologies and examples of its modifications according to sustainable development principals. Acquainting students with rules and examples of designing and using cleaner technologies. Presentation of fundamental industrial waste streams and waste management techniques. Organic chemical technology: Production processes of bulk organic chemicals and global chemicals outlook. Effect of the environmental law on the technological processes. Conventional and green solvents. Fuels - conventional and reformulated. Oxygenates (alcohols and ethers) for the new reformulated gasolines. Controversy over MTBE in gasoline. Hydrogen production and application. LNG and syngas. Surface active agents. Some chosen problems in organic synthesis industry: water and steam, waste gases utilization, storage, distribution and transport of

	chemicals, soil contamination and remediation.
Recommended reading:	**Inorganic chemical technology:** 1.T. W. Swaddle , "Inorganic Chemistry: An Industrial and Environmental Perspective" Academic Press; 1 edition (February 24, 1997) 2.*Martin B. Hocking* -Handbook of Chemical Technology and Pollution Control (Third Edition) 2005 Elsevier 3.Toy A.D.F- The Chemistry of phosphorus, Pergamon Press, 1975 4.S.Brett, J.Guy, G K Morse and JN Lester — Phosphorus removal and recovery technologies, London, 1997, Selper publication 5.Wan Wazer — Phosphorus and its Compounds, London, 1958, Interscience publishers 6.Ullmans Encyklopedia 2006 7.Nicholas P. Cheremisinoff and Paul Rosenfeld-Handbook of Pollution Prevention and Cleaner Production , 2010 Elsevier Inc 8. *Trevor Letcher and Daniel Vallero* -Waste, A Handbook for Management, 2011 Elsevier Inc 9. Nicholas P. Cheremisinoff -Handbook of Solid Waste Management and Waste Minimization Technologies, 2003 Elsevier Inc 10. Salah M. El-Haggar,- Sustainable Industrial Design and Waste Management, 2007 Elsevier Ltd. **Organic chemical technology:** 1. Petroleum Refining. Technology and Economics. Fifth edition James H.Gary, Glenn E. Handwerk, Mak J. Kaiser, CRC Press Taylor and Francis Group, New York 2007 2. Lurgi MegaMethanol® http://lurgi.com/website/fileadmin/user_upload/1_PDF/1_Broshures_Flyer/englisch/0312e_MegaMethanol.pdf 3. Linde Isothermal Reactor http://www.linde-india.com/userfiles/image/File/Linde%20Isothermal%20

	Reactor.pdf 4. Methanol from Natural Gas by ICI's LP Process (High Efficiency Design) Aspen Model Documentation http://www.diquima.upm.es/docencia/tqindustrial/docs/metanol.pdf 5. Acrylonitrile by Propene Ammoxidation http://tekim.undip.ac.id/staf/istadi/files/2009/05/topik51.pdf 6. CHEMSYSTEM PERP Program Styrene/Ethylbenzene 07/08-4 March 2009, Report prepared by Nexant Inc., http://www.chemsystems.com/reports/search/docs/abstracts/0708_4_abs.pdf 7. Handbook of Commercial Catalysts: Heterogeneous Catalysts, Howard F. Rase , CRC Press; 1 edition (March 24, 2000) 8. Catalysis of Organic Reactions (Chemical Industries), Dennis G. Morrell (Nov 13, 2002), CRC Press; 1 edition (November 13, 2002) 9. Ethylene oxide. Third edition. The Ethylene Oxide Product Stewardship Guidance Manual, American Chemistry Council's Ethylene Oxide/Ethylene Glycols Panel http://www.sunocochem.com/HES/tech_manuals_EthyleneOxide.pdf 10. Global Chemicals Outlook.Pillar I: Trends and Indicators 4. 1 Bulk Organic Chemicals , p 12 - Rachel Massey1 & Molly Jacobs2 , November 8, 2011 http://www.unep.org/hazardoussubstances/Portals/9/Mainstreaming/GCO%205th%20SC/GCO%20pillar%20I%20Draft%20Nov%2021.pdf
Educational effects:	Student knows classification of mineral fertilizers, its characteristic and quality as well as production methods including interdisciplinary research. Student knows principles of modern fertilizing and understand mechanism of nutrients transformations and assimilation. Student knows advantages and disadvantages of basic inorganic technologies, directions of its development and has skills for its analysis and assessment. Students knows basics methods of waste management and waste characteristics

	Student is able to ascribe evidence number to each waste and knows effective ways for reducing and preventing waste production. Student is able to make objective assessment of waste management examples. Student knows main industrial methods of bulk organic chemicals production. Student is aware of the environmental law influence on the technology. Student knows advantages and disadvantages of basic organic technologies and trends towards "green chemistry" and "green" products. Student is able to analyze and assess the influence of the technology on the environment. Students knows methods of waste gases utilization. Student is aware of potential environment contamination and understands the necessity of prevention in the production, storage and transport processes.
Teaching methods:	lecture, 3h per week
Prerequisites	no
Assessment method:	Writing test
Name of lecturer:	dr inż. Katarzyna Gorazda dr inż.Krystyna Porzycka-Semczuk
Contact person:	Katarzyna Gorazda, dr inż. , 12 628 27 96, gorazda@chemia.pk.edu.pl Krystyna Porzycka-Semczuk, dr inż., 12 628 21 11, kporz@chemia.pk.edu.pl

kod	**Chemical Technology II**								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		

Module supervisor: Krystyna Porzycka-Semczuk, Ph.D.

Course description:

Presentation of fertilizers production technologies and rules for its application, sodium phosphates production technologies and its application. Discussion on advantages and disadvantages of basic inorganic technologies and examples of its modifications according to sustainable development principals. Acquainting students with rules and examples of designing and using cleaner technologies.

Presentation of fundamental industrial waste streams and waste management techniques.

Production processes of bulk organic chemicals. Global chemicals outlook. Effect of the environmental law on the technological processes.

Environmentally friendly (eco-friendly, nature friendly, green) products:

Conventional and green solvents.

Fuels - conventional and reformulated. Oxygenates (alcohols and ethers) for the new reformulated gasolines. Controversy over MTBE in gasoline.

Hydrogen production and application. LNG and syngas. Deep hydrodesulfurization of Diesel fuels and influence of these processes on technology and fuel and automotive markets.

Surface active agents.

Some chosen problems in organic synthesis industry:

Education effects – learning and competences:

Student knows classification of mineral fertilizers, its characteristic and quality as well as production methods including interdisciplinary research.

Student knows principles of modern fertilizing and understand mechanism of nutrients transformations and assimilation.

Student knows advantages and disadvantages of basic inorganic technologies, directions of its development and has skills for its analysis and assessment.

Students knows basics methods of waste management and waste characteristics

Student is able to ascribe evidence number to each waste and knows effective ways for reducing and preventing waste production.

Student is able to make objective assessment of waste management examples.

Student knows main industrial methods of bulk organic chemicals production.

Student is aware of the environmental law influence on the technology.

Student knows advantages and disadvantages of basic organic technologies and trends towards “green chemistry” and “green” products.

Student is able to analyze and assess the influence of technology on the environment.

Students knows methods of waste gases utilization. Student is aware of potential environment contamination and understands the necessity of prevention in the production, storage and transport processes.

SUBJECTS OF LECTURES

Inorganic technology

No.	Subject	Main issues	Number of hours
1	Fertilizers production technologies	Characteristic of soil environment, functions and division of selected nutrients, fertilizers classification, production technologies of nitrogen and	**6**

		phosphoric fertilizers, one- and two-component fertilizers, characteristic of multi-component fertilizers, mixed and complex fertilizers, characteristic and problems of the fertilizers market, new solutions at raw materials	
2	Sodium phosphates production technologies	Sodium pyrophosphate and tripoliphosphate production methods and its properties	**2**
3	Advantages and disadvantages of basic inorganic technologies, sustainable development	Definition of sustainable development, analysis and assessment of technological process, advantages and disadvantages of basic inorganic technologies and directions of its development	**3**
4	Industrial waste streams and waste management techniques	Basic definition and classification of waste, waste management rules, waste accounting, waste quality and quantity characteristics according to group distribution, methods for waste quantity reduction, waste treatment in accordance with management hierarch	**4**

Organic technology

No.	Subject	Main issues	Number of hours
1	Bulk organic chemicals and global chemicals outlook.	A review of the industrial processes used in the production of major primary bulk organic chemicals: - methanol and acetic acid,	**10**

		- ethylene and propylene oxides, ethylene glycol - styrene, cumene, phenol - acrylonitrile - vinyl acetate and chloride Their application and market trends.	
2	Conventional and green solvents.	Petroleum derived and other organic solvents. Production methods, composition and properties of conventional solvents. Health and environmental hazards connected with these solvents. Green chemistry. Green solvents. How green is my solvent? Ionic liquids. Tuneable solvents.	**3**
4	Hydrogen and natural gas.	Hydrogen production and application. Syngas as a source material. A typical LNG process. LNG carriers. Influence of shale gas extraction and the Fukushima Daiichi nuclear disaster on the LNG market.	**2**
5	Surface active agents.	Surfactant classification according to the composition of their head: nonionic, anionic, cationic, amphoteric. Application of surface active agents. Current market and forecast. Surface-active compounds as basic components for household chemistry products.	**2**
6	Chosen problems in organic synthesis industry: Water and steam	Main water intake parameters. Special requirements for steam production. Boilers. Cooling towers. Main processes in Waste Water Treatment Plant. Water balance – upstream and downstream effects of recycling and water reuse. Condensates and stormwater collection and reuse.	**2**

7	Chosen problems in organic synthesis industry: Waste gases.	Waste gases utilization and disposal. Flaring. Steam-assisted smokeless flares construction, operation and control.	**2**
8	Chosen problems in organic synthesis industry: Storage, distribution and transport of chemicals.	Bulk storage tanks for gases, liquids and solids. Means of transport. Environment protection in storage, transport and distribution processes.	**2**
9	Chosen problems in organic synthesis industry: Soil contamination.	Soil contamination by organic chemicals. Main remediation methods. Prevention of soil contamination.	**1**

Total: 15 +30 = 45

Syllabus in English

COURSE TITLE:	**Process Dynamics**
Institute/Division:	Chemical and Process Engineering Institute
Course code:	
Type of course:	Obligatory
Number of contact hours:	60
Semester of study:	SI-2/1
ECTS credits:	5
Course description:	Elements of dynamics the linear and nonlinear systems. Formulation the dynamics models of chosen systems. Methods of investigation of the steady states structure. Selected mathematical methods of the research of dynamics system. Identification of chemical engineering systems. Basics of process safety.
Recommended reading:	- W. L. Luyben. Process Modeling, Simulation, and Control for Chemical Engineers. McGraw-Hill, 1990, - K. M. Hangos, J. Bokor, Analysis and Control of Nonlinear Process Systems, Sprnger 2004, - L. Ljung. Modeling of Dynamic Systems, PTR 1994, - D. Pollok. A Handbook of Time Series Analysis, Signal Processing and Dynamics. Academic Press 1999, - J.D. Meiss. Differential Dynamical Systems. SIAM 2007, - J. Ingham, I. J. Dunn, E. Heinzle, J. E. Pfenosil. Chemical Engineering Dynamics. WILEY-VCH 2000.
Educational effects:	After finishing course student should:

	- to know how to formulating dynamics model of analyzed process - to know how to programming the mathematical model for numerical calculation for simulation, - to know how to using the software to dynamics analysis: Dynamics and Madonna, - to know how to carrying out the analysis of dynamics for typical systems in chemical engineering, - to know how to carrying out the identification of typical system of chemical engineering, - to know how to evaluating process safety conditions.
Teaching methods:	Lectures 2 hours per week Exercises 1 hour per week Project 1 hour per week
Prerequisites	Courses: Chemical Engineering, Mathematics, Applied Mathematics, Numerical Methods, Chemical Reactors Engineering. Skills: Computer literacy, program in chosen High Level Programming Language: Fortran, Pascal, C; basic knowledge Software Package Matlab.
Assessment method:	written examination
Name of lecturer:	
Contact person:	Robert Grzywacz, dr inż, 6282754, robekk@gmail.com

SI-2/1		Process Dynamics							
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
		60	2	1			1	E	**5**

Module supervisor:
Course description: **Basic of dynamics of the linear and nonlinear chemical engineering systems.** **Formulating the dynamics models of process. Methods stability research of dynamics systems. Analysis of object dynamics in real time domain.** **Software to investigation of dynamics systems. Elements of dynamics of chaotic systems. Analysis of dynamics in frequency domain. Analysis the dynamics by input-output methods. Identification of chemical engineering systems. Basics of process safety.**

Education effects – learning and competences:

- **to know how to formulating dynamics model of analyzed process**
- **to know how to programming the mathematical model for numerical calculation for simulation,**
- **to know how to using the software to dynamics analysis: Dynamics and Madonna,**
- **to know how to carrying out the analysis of dynamics for typical systems in chemical engineering,**
- **to know how to carrying out the identification of typical system of chemical engineering,**
- **to know how to evaluating process safety conditions.**

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	Basic of dynamics of the linear and nonlinear chemical engineering systems.	Characteristics the linear and nonlinear chemical engineering systems. Elements of dynamics the linear systems. Elements the dynamics of nonlinear systems. Eigenvalue.	4
2	Formulating the dynamics models of process.	Formulating of dynamics equation of linear and nonlinear objects with intensive and extensive variable.	3
3	Methods stability research of dynamics systems.	Methods for investigation of steady states structure. Steady states continuation. Methods for determining the nature of steady states.	4
4	Software to investigation of dynamics systems.	Selected software to analysis o steady states: Auto, Matcont. Selected software to analysis of dynamics: Dynamics, Madonna.	2

5	**Analysis of object dynamics in real time domain.**	**Methods for determining the local stability. Methods for solving dynamics models. Visualization solutions. Time series analysis.**	**4**
6	**Elements of dynamics of chaotic systems.**	**Deterministic chaos phenomena in chemical reacting systems. Came paths to chaos. Strange attractors.**	**3**
7	**Analysis of dynamics in frequency domain.**	**Determining of transmittance for chemical engineering units. Determining and investigation property of frequency characteristics.**	**4**
8	**Analysis the dynamics by input-output methods.**	**Basics input-output methods. Typical systems and their research methods.**	**2**
9	**Identification of chemical engineering systems.**	**Methods of identification. Basics and application of the momentum methods.**	**2**
10	**Basics of process safety.**	**Typical conditions of process hazards.** **Determination of process safety. Determination of the run-away conditions.**	**2**

SUBJECTS OF EXERCISES

No.	**Subject**	**Main issues**	**Number of hours**
1	**Formulating the dynamics models of chemical engineering process.**	**Formulating of dynamics equation of linear and nonlinear objects with intensive and extensive variable.**	**2**
2	**Methods stability research of dynamics systems.**	**Determination of steady states structure. Methods for determining of steady states branches.**	**2**
3	**Analysis of object dynamics in real time domain.**	**Methods for determining the local stability. Visualization solutions. Time series and phase portraits analysis.**	**4**

4	**Software to investigation of dynamics systems.**	**Selected software to analysis o steady states: Auto, Matcont.** **Selected software to analysis of dynamics: Dynamics, Madonna.**	**2**
5	**Analysis of dynamics in frequency domain.**	**Determining of transmittance for chemical engineering units. Determining and investigation property of frequency characteristics.**	**4**
6	**Identification of chemical engineering systems.**	**Application of the momentum methods to selected chemical engineering systems.**	**1**

PROJECTS

The Work Programme Framework

1. **Perform the stability analysis of the selected systems with intensive variable. Application of the software Matcont.**
2. **Perform the stability analysis of the bioreactor with given kinetics. Analysis done using software Matcont.**
3. **Carry out the dynamics analysis for selected chemical reactor with given kinetics. Application of the software Madonna.**
4. **Carry out the dynamics analysis for selected systems with intensive variable. Application of the software Dynamics.**
5. **Perform the dynamics analysis of the tank-in-series continuous reactors in frequency domain . Analyze the impact of time delay.**

Syllabus in English

COURSE TITLE:	**Modelling of energy mass and momentum transport**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	SI-2/4
Type of course:	Obligatory
Number of contact hours:	30
Semester of study:	1
ECTS credits:	2
Course description:	General transport equations, equation of mass and momentum transport, equation of energy transport. Classification of transport process models. Models with molecular transport coefficients, models builded using Lagrange analysis, flow of liquids in membranes, pipes and boundary layers, movement of particles droplets and bubbles in liquid and in porous beds, discrete system models. Hydrodynamics and energy and mass transport in non-newtonian fluids.
Recommended reading:	- AsanoK., Mass Transfer, . Membrane separation Technology, Gulf PP, 2003. - Wesseling P. Principles of Computational Fluid Dynamics, Springer, Berlin 2001. - Häfner F., Sames D., Voigt H-D., Wärme und Stofftransport; Matematische Methoden, Springer, Berlin 1992.
Educational effects:	Student is able to provide transport models in different notations. Student knows how to solve problems of energy, mass and momentum transport for a perfect fluid. Student is able to solve transport problems for non-Newtonian fluid. Student knows, how to determine the transport coefficients, for different types of fluids.
Teaching methods:	Lectures 1 h, Exercises 1 h (weekly)

Prerequisites	B.Sc. degree in chemical engineering or similar field.
Assessment method:	- tests, - continuous assesment
Name of lecturer:	Barbara TAL-FIGIEL, Ass.Prof. Ph.D., D.Sc.,
Contact person:	Barbara TAL-FIGIEL, Ass.Prof. Ph.D., D.Sc., 12 6282739, email: btfigiel@pk.edu.pl

SI-2/4	MODELLING OF ENERGY MASS AND MOMENTUM TRANSPORT								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		

Module supervisor: Barbara TAL-FIGIEL, Ass.Prof. Ph.D., D.Sc.

Course description:

General transport equations, equation of mass and momentum transport, equation of energy transport. Classification of transport process models. Models with molecular transport coefficients, models builded using Lagrange analysis, flow of liquids in membranes, pipes and boundary layers, movement of particles droplets and bubbles in liquid and in porous beds, discrete system models. Hydrodynamics and energy and mass transport in non-newtonian fluids.

Education effects – learning and competences:

Student is able to provide transport models in different notations.

Student knows how to solve problems of energy, mass and momentum transport for a perfect fluid.

Student is able to solve transport problems for non-Newtonian fluid.

Student knows, how to determine the transport coefficients, for different types of fluids.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	**Introduction to transfer processes modeling**	**Ekstensive variables and intensive parameters Apparent boundary. Balance space.**	**2**
2	**General transfer equations. Equations of mass and momentum transfer. Equations of energy transfer.**	**Integral and differential momentum balances. Euler and Cauchy laws. Material properties and constitutive equations.**	**3**
3	**Transfer equations in various coordinate systems and using various notation.**	**Mass transfer equations in various coordinate systems and with various notation methods.** **Momentum transfer equations in various coordinate systems and with various notation methods.** **Energy transfer equations in various coordinate systems and with various**	**3**

		notation methods. **Stress tensor components In various coordinate systems.**	
4	**Transfer process models classification.**	**Models classification from the point of minutenes degree of description. Molecular description. Balance models in thin film. Models with molecular transfer coefficients. Boundary layer model. Models with effective transfer coefficients (turbulencje models). Models of discrete systems. Models constructed on the basis of Lagrangian analysis.**	**4**
5	**Flow of fluids**	**Fluid flow in sheets, pipes and boundary layers, movement of particles, drops and bubbles in fluids and in porose systems.** **Hydrodynamics and energy and mass transfer in non-newtonian fluids.**	**3**

SUBJECTS OF EXERCISES

No.	Subject	Main issues	Number of hours
1	Introduction to transfer processes modeling	Ekstensive variables and intensive parameters Apparent boundary. Balance space.	2
2	General transfer equations. Equations of mass and momentum transfer. Equations of energy transfer.	Integral and differential momentum balances. Euler and Cauchy laws. Material properties and constitutive equations.	3
3	Transfer equations in various coordinate systems and using various notation.	Mass transfer equations in various coordinate systems and with various notation methods. Momentum transfer equations in various coordinate systems and with various notation methods. Energy transfer equations in various coordinate systems and with various notation methods. Stress tensor components In various coordinate systems.	3
4	Transfer process models classification.	Models classification from the point of minutenes degree of description. Molecular description. Balance models in thin film. Models with molecular transfer coefficients. Boundary layer model. Models with effective transfer coefficients (turbulencje models). Models of discrete systems. Models constructed on the basis of Lagrangian analysis.	4
5	Flow of fluids	Fluid flow in sheets, pipes and boundary layers, movement of particles, drops and bubbles in fluids and in porose systems. Hydrodynamics and energy and mass transfer in non-newtonian	3

		fluids.	

Syllabus in English

COURSE TITLE:	**COMPUTATIONAL METHODS IN CHEMICAL ENGINEERING**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	
Type of course:	Obligatory
Number of contact hours:	30 + 30
Semester of study:	1 + 2 (2. degree)
ECTS credits:	2 (lectures, exersises) + 2 (computers laboratory)
Course description:	Computational methods in chemical engineering are the bridge between chemical engineering and applied mathematics. Numerical methods, which are necessary in most of the problems occurring in exact and technical sciences, are the substance of the subject. The main emphasis was put on practical realization of the calculations, as it was assumed that students have mastered the theoretical part during the mathematics course. During the laboratory of Computational methods in chemical engineering, students will become familiar with computer implementation of numerical calculations. Both commercial software for numerical calculations and educational programs, which allow easy visualization of the steps of calculation, will be used.
Recommended reading:	- B.A. Finlayson, Introduction to Chemical Engineering Computing, University of Washington, Seattle 2005. - T. Sauer, Numerical Analysis, Pearson Education Inc., 2006. - Z. Fortuna, B. Macukow, J. Wąsowski, Metody numeryczne, WNT Warszawa 1982. - T. Traczyk, M. Mączyński, Matematyka stosowana w inżynierii chemicznej, WNT Warszawa 1970. - A.Marciniak, D.Gregulec, J.Kaczmarek, Basic Numerical

	Procedures in Turbo Pascal for your PC, Nakom, Poznan 1992.
Educational effects:	A student should acquire the skills of computational tools selection. These tools should be chosen properly to the problem to be solved and include a calculator, MathCAD, a simulator e.g. ASPEN, or own calculation program in an algorithmic language. The student should be aware that a computer is only a calculation tool, whereas the computational process is created and controlled by man. The acquisition of the following skills: • selection of computational tools, • implementation of simple programs for solving typical computational problems in process engineering, chemistry and technology, • utilization of packaged applications.
Teaching methods:	Lectures 1hour per week Exercises 1hour per week Computers laboratories 1 hour per week
Prerequisites	Mathematics, Flow processes, Heat transfer processes, Mass transfer processes, Chemical reactors engineering
Assessment method:	Student assessment is based on their tests results. Each student gets numerical problem to solve during the test (individual problem for each student). Calculations are being done using electronic calculator. It is required to obtain the correct result, and provide the desired intermediate results. Student assessment is based on their activity during the laboratory and skills of handling computer programs which are used during the course.
Name of lecturer:	
Contact person:	Krzysztof Kupiec, 12 628 2735, kkupiec@chemia.pk.edu.pl

kod	Computational methods in chemical engineering								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	1	30	1	1					2
1	2	30				2			2

Module supervisor:
Course description: General information, fundamentals of programming, solving systems of algebraic linear equations, interpolation, approximation, the least squares method, solving algebraic nonlinear equations: the bisection method, the method of simple iteration, the regula falsi method, the Newton's method, solving systems of nonlinear equations, numerical differentiation, numerical integration, ordinary differential equations, systems of ordinary differential equations, partial differential equations, genetic algorithms, Monte Carlo methods

Education effects – learning and competences:

The acquisition of the following skills:

- proper selection of computational tools,
- implementation of simple programs for solving typical computational problems in process engineering, chemistry and technology,
- utilization of packaged applications.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	General information, fundamentals of programming	The concept of numerical methods, computational algorithms, computational errors. Computational tools: calculator, Excel, MathCAD, own programs in a programming language e.g. C++, Turbo Pascal, Fortran.	**1**
2	Solving systems of algebraic linear equations	Direct methods for solving systems of linear equations: Gaussian elimination, the Cholesky-Banachiewicz method for a symmetric positive-definite matrix, the Thomas method for a tridiagonal matrix.	**1**
3	Interpolation	Differences between interpolation and approximation, linear interpolation, polynomial interpolation, Lagrange interpolation, Newton interpolation.	**1**

		Spline interpolation: fundamental concepts of the theory of spline functions, properties of spline functions, natural spline functions, formation of cubic spline functions.	
4	Approximation	Mean-square approximation, polynomial approximation, orthogonal polynomials.	**1**
5	The least squares metod (1)	The principle of the method, the least squares method for a linear function of one variable and for a linear function of many variables. Transformation of equations of nonlinear model into a linear form.	**1**
6	The least squares metod (2)	The least squares method for nonlinear functions. Regression and correlation, the correlation coefficient. A measurement error and a model error.	**1**
7	Solving nonlinear equations	The bisection method, the method of simple iteration, the convergence condition, the regula falsi method, the Newton's method, the convergence condition for the Newton's method. Utilization of values of derivatives determined both analytically and numerically.	**1**
8	Solving systems of nonlinear equations	The method of ordering and decomposition of equations. Iterative methods without partial derivatives: the Gauss-Jacobi method. Iterative methods with partial derivatives: the Newton-Raphson method. The Jacobian matrix. Calculation of partial derivatives of functions of many variables.	**1**
9	Numerical differentiation	Application of the difference quotient for determining values of functions derivatives. Differentiation with the use	**1**

		of Lagrange and Newton interpolation formulas.	
10	Numerical integration	The trapezoid rule, the Simpson's rule, the Newton-Cotes method. Calculation of improper integrals.	**1**
11	Ordinary differential equations	The Euler's method, the Runge-Kutta method, first-order equations, higher-order equations. Transient motion of a falling spherical particle.	**1**
12	Systems of ordinary differential equations	Boundary value problem, the shots method, the orthogonal collocation method. Example: changes in reagents concentration for a system of multiple reactions.	**1**
13	Partial differential equations	Classification of partial differential equations: elliptic, parabolic and hyperbolic equations. The method of finite differences, differential schemes, the stability of solutions, the Crank-Nicholson method. The Fourier-Fick equation. First- and third-type boundary conditions.	**1**
14	Genetic algorithms	Application of genetic algorithms. Encoding of numbers, the binary system. Fundamental terms in genetics: chromosomes, gen, population, generation, fitness function. Genetic algorithm flowchart. Fundamental genetic operations: selection, crossing-over, mutation. Algorithmic interpretation of selection: the roulette selection method.	**1**
15	Monte Carlo methods	Random numbers. Generators of pseudorandom numbers. The idea of Monte Carlo methods. Calculation of areas of plane shapes using Monte Carlo methods. Application in problems of chemical engineering and	**1**

		technology.	

SUBJECTS OF EXERCISES

No.	Subject	Main issues	Number of hours
1	General information, fundamentals of programming	Computational algorithms. Computational tools: calculator, Excel, MathCAD, own program written in a programming language e.g., C++, Turbo Pascal, Fortran.	1
2	Solving systems of algebraic linear equations	Matrix algebra: operations with matrices, the rank of a matrix, triangular and symmetric matrices, tridiagonal matrices, application of matrix algebra in problems of chemical engineering and technology. A matrix with linearly dependent rows, an ill-conditioned matrix.	1
3	Interpolation	Lagrange interpolation, Newton interpolation, spline interpolation: formation of cubic spline functions. Example: relationship between liquid density and temperature.	1
4	Approximation	Application of polynomial approximation in thermodynamics, approximation of excess functions with orthogonal polynomials. Determination of coefficients of orthogonal polynomials.	1
5	The least squares method (1)	The principle of the method, the least squares method for a linear function of one variable: $y = b$, $y = ax$, $y = ax+b$ models.	1
6	The least squares method (2)	The least squares method for a linear function of many variables. Nonlinear approximation. Determination of	1

		coefficients of empirical relationships.	
7	The least squares method (3)	Transformation of nonlinear model equations into a linear form. Regression and correlation, the correlation coefficient. Application in chemical engineering and technology: relationship between saturated vapor pressure and temperature.	**1**
8	Solving nonlinear equations (1)	The bisection method, the method of simple iteration, the convergence condition. Examples of solving nonlinear equations, including equations with trigonometric functions.	**1**
9	Solving nonlinear equations (2)	The regula falsi method, the Newton's method, the convergence condition for the Newton's method. Utilization of values of derivatives determined both analytically and numerically. Examples of solving nonlinear equations, including equations with trigonometric functions.	**1**
10	Solving nonlinear equations (3)	Solving nonlinear equations occurring in problems of chemical engineering and technology: the equations of state, calculation of the boiling point of a multi-component mixture.	**1**
11	Solving systems of nonlinear equations	The method of ordering and decomposition of equations. Iterative methods without partial derivatives: the Gauss-Jacobi method. Iterative methods with partial derivatives: the Newton-Raphson method. The Jacobian matrix. Calculation of partial derivatives of functions of many variables.	**1**
12	Numerical differentiation and integration	Numerical calculation of a derivative value on the basis of the difference quotient. Calculation of definite integrals in	**1**

		problems of chemical engineering: determination of the number of mass transfer units, the average driving force of heat and mass transfer processes, the average velocity of the flowing fluid. Calculation of improper integrals.	
13	Ordinary differential equations	Initial value problem. The Euler's method, the Runge-Kutta method. Transient motion of a falling spherical particle; non-isothermal reaction in a reactor with perfect mixing.	**1**
14	Systems of ordinary differential equations	Liquid outflow from cascade-connected tanks, liquid flow through a cascade of tanks with perfect mixing, temperature distribution for co-current and counter-current heat exchangers. Calculation of a mass exchanger, including longitudinal dispersion. Boundary value problem, the shots method, the orthogonal collocation method.	**1**
15	Partial differential equations	The method of finite differences, differential schemes, the stability of solutions, the Crank-Nicholson method. The equation of transient heat conduction (Fourier) or mass diffusion (Fick) for an infinite slab, infinite cylinder or sphere. First- and third-type boundary conditions. Comparison of analytical and numerical solutions.	**1**

LABORATORY SUBJECTS

No.	**Subject**	**Enclosure**	**Number of hours**
1	Fundamentals of programming	**Laboratory Instruction No 1**	**2**
2	Solving systems of algebraic linear equations	**Laboratory Instruction No 2**	**2**
3	Interpolation and approximation	**Laboratory Instruction No 3**	**2**

4	The least squares method (1)	**Laboratory Instruction No 4**	**2**
5	The least squares method (2)	**Laboratory Instruction No 5**	**2**
6	The least squares method (3)	**Laboratory Instruction No 6**	**2**
7	Solving nonlinear equations (1)	**Laboratory Instruction No 7**	**2**
8	Solving nonlinear equations (2)	**Laboratory Instruction No 8**	**2**
9	Solving systems of nonlinear equations	**Laboratory Instruction No 9**	**2**
10	Numerical differentiation and integration	**Laboratory Instruction No 10**	**2**
11	Ordinary differential equations	**Laboratory Instruction No 11**	**2**
12	Systems of ordinary differential equations	**Laboratory Instruction No 12**	**2**
13	Partial differential equations	**Laboratory Instruction No 13**	**2**
14	Genetic algorithms	**Laboratory Instruction No 14**	**2**
15	Monte Carlo methods	**Laboratory Instruction No 15**	**2**

Laboratory Instruction No 1

Subject: **„Fundamentals of programming"**

Getting acquainted with MathCAD, Grapher and Turbo Pascal applications.
MathCAD: arithmetic expressions, arithmetic functions, conditional statements, loop statements, data input and output, elements of graphics, drawing graphs.
Grapher: spreadsheet, arithmetic expressions, fitting the model to the figures, axes of the chart and their description, a legend.
Turbo Pascal: fundamental elements of programming languages, program structure, keywords, data types, constants and variables, indexed variables, arithmetic

expressions, arithmetic functions, conditional statements, loop statements, subroutines, data input and output, elements of graphics, drawing graphs. Examples of simple programs in Turbo Pascal.

Laboratory Instruction No 2

Subject: „Solving systems of linear algebraic equations"

Getting acquainted with methods for solving systems of linear algebraic equations. Methods of using computer applications for solving systems of linear algebraic equations; data input and output. The Gaussian elimination, the Cholesky-Banachiewicz method, the Thomas' method for a tridiagonal matrix. Iterative methods for solving system of linear algebraic equations: the Jacobi's iterative method, the Gauss-Seidel method. The use of matrix algebra in problems of chemical engineering and technology, stoichiometric calculations, calculation of equivalent molar mass of a mixture (the scalar product).

Laboratory Instruction No 3

Subject: „Interpolation and approximation"

Methods of using computer applications for solving interpolation problems. Linear interpolation, polynomial interpolation, Lagrange interpolation, Newton interpolation, spline interpolation.

Spline smoothing of curves on charts. Mean-square approximation, polynomial approximation, orthogonal polynomials. Application in thermodynamics: approximation of excess functions with orthogonal polynomials. The use of computer applications for solving approximation problems, determination of coefficients of orthogonal polynomials.

Laboratory Instruction No 4

Subject: „The least squares method (1)"

The least squares method for a linear function of one variable, data input, results interpretation. The use of the Grapher application for solving linear problems with one variable. Regression and correlation, the coefficient of correlation. A measurement error and a model error. Comparison of the following models: $y = b$, $y = ax$, $y = ax+b$.

Laboratory Instruction No 5

Subject: „The least squares method (2)"

The least squares method for a linear function of many variables. Transformation of nonlinear model equations into a linear form.
Application in chemical engineering and technology: determination of the coefficients in empirical relationships. Graphical interpretation of fitting a model to experimental data.

Laboratory Instruction No 6

Subject: „The least squares method (3)

The least squares method for nonlinear functions. Application in chemical engineering and technology: determination of the coefficients in empirical relationships. Determination of the

coefficients of a relationship between saturated vapor pressure and temperature: the Clausius-Clapeyron equation, the Antoine equation. Graphical interpretation of fitting a model to experimental data.

Laboratory Instruction No 7

Subject: „Solving nonlinear equations (1)"

Methods for using computer applications for solving algebraic nonlinear equations.
The bisection method, the method of simple iteration, the convergence condition.
Programming of iterative methods for solving nonlinear equations, the stop condition, problems of multiple solutions (trigonometric functions).
Solving nonlinear equations occurring in problems of chemical engineering and technology: the equations of state, calculation of the boiling point of a multi-component mixture.

Laboratory Instruction No 8

Subject: „Solving nonlinear equations (2)"

Methods for using computer applications for solving algebraic nonlinear equations.
The regula falsi method, the Newton's method, the convergence condition for the Newton's method. Utilization of values of derivatives determined both analytically and numerically. Solving nonlinear equations occurring in problems of chemical engineering and technology: the equations of state, calculation of the boiling point of a multi-component mixture.

Laboratory Instruction No 9

Subject: „Solving systems of nonlinear equations"

Methods for using computer applications for solving systems of algebraic nonlinear equations.
Iterative methods without partial derivatives: the Gauss-Jacobi method.

Iterative methods with partial derivatives: the Newton-Raphson method. The Jacobian matrix.
Calculation of partial derivatives of functions of many variables.
Utilization of derivatives values determined analytically (the Newton's method) and numerically (the Brown's method).

Solving nonlinear equations occurring in chemistry problems: calculation of the composition of a mixture in electrolyte solutions when chemical equilibrium constants are known.
Solving nonlinear equations occurring in problems of chemical engineering and technology: calculation of the coefficients of linear regression, calculation of wall temperature during heat transfer.

Laboratory Instruction No 10

Subject: „Numerical differentiation and integration"

Methods for using computer applications for calculating a derivative of a function.

Differentiation using the Lagrange's and Newton's methods.

Differentiation occurring in problems of chemical engineering.

Methods for using computer applications for calculating values of definite integrals.
Application of the trapezoid rule, the Simpson's rule, the Newton-Cotes method.
Calculation of definite integrals in problems of chemical engineering: determination of the number of mass transfer units, determination of the average driving force of heat and mass transfer processes, determination of the average velocity of the flowing fluid, calculation of the time of liquid outflow from a tank, calculation of length of a pipe reactor.
Calculation of improper integrals.

Laboratory Instruction No 11

Subject: „Ordinary differential equations"

Methods for using computer applications for integration of ordinary differential equations.
An initial value problem, application of the Euler's method and the Runge-Kutta method.

Problems occurring in chemical engineering: transient motion of a falling spherical particle, non-isothermal reaction in a reactor with perfect mixing.

Laboratory Instruction No 12

Subject: „Systems of ordinary differential equations"

Methods for using computer applications for integration of ordinary differential equations. Application of the Euler's method and the Runge-Kutta method.
Problems occurring in chemical engineering: liquid flow through a cascade of tanks with perfect mixing, liquid outflow from cascade-connected tanks.
Boundary value problem, the shots method. Temperature distribution for co-current and counter-current heat exchangers. The orthogonal collocation method.

Laboratory Instruction No 13

Subject: „Partial differential equations"

Methods for using computer applications for solving partial differential equations. The method of finite differences, differential schemes, the stability of solutions, the Crank-Nicholson method.
Solving problems in chemical engineering: the equation of transient heat conduction (Fourier) or mass diffusion (Fick) for an infinite slab, infinite cylinder or sphere.
Interpretation of first- and third-type boundary conditions.
Comparison of analytical and numerical solutions.

Laboratory Instruction No 14

Subject: „Genetic algorithms"

Methods for using computer applications for generation of pseudo-random numbers. Basic genetic operations: selection, crossing-over, mutation. Algorithmic interpretation of selection: the roulette selection method. Numerical examples. Searching for a minimum of one variable. Searching for a minimum of two variables.

Laboratory Instruction No 15

Subject: „Monte Carlo methods"

Methods for using computer applications for generation of pseudo-random numbers.

Calculation of areas of plane shapes using Monte Carlo methods.

Application in problems of chemical engineering and technology: study of courses of parallel and serial reactions with different relationships between the equilibrium constants. Study of autocatalytic reactions.

Syllabus in English

COURSE TITLE:	**SI-2_07 - Multiphase Flows – exercises**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	
Type of course:	Obligatory
Number of contact hours:	15
Semester of study:	1
ECTS credits:	
Course description:	This course gives students the opportunity to perform calculations (under the lecturer's supervision) related to the topics introduced during the lectures. Hydraulic calculations for fixed-bed and moving-bed columns, examples concerning the settling of solid particles in fluids, barbotage, thin film flow, pressure drop in hydraulic and pneumatic transport and practical

	use of two-phase flow maps constitute the basis for further design of multiphase flow devices.
Recommended reading:	- Kembłowski Z., Michałowski S., Strumiłło Cz., Zarzycki R., Podstawy Inżynierii Chemicznej i Procesowej, Warszawa, 1985, WNT - Daraiswamy I.K., Mujumdar A.S., Transport in Fluidized Particle Systems, Amsterdam, 1998, Elsevier - Coker A. Cayode, Ludwig's Applied Process Design for Chemical and Petrochemical Plants, Amsterdam, 2010, Elsevier - Dziubiński M., Hydrodynamika Przepływu Mieszanin Dwufazowych ciecz-gaz, Łódź, 2005, Wydawnictwo Politechniki Łódzkiej - Polarski J., Hydrotransport, Warszawa, 1982, WNT - Ciesielczyk W., Kupiec K., Wiechowski A., Przykłady i Zadania z Inżynierii Chemicznej i Procesowej, Cz. 1 i 2, Kraków, 1989, Wydawnictwo Politechniki Krakowskiej
Educational effects:	After completing this practical part of the course on *Multiphase Flows*, the students should get a grasp of basic issues related to multiphase flow hydrodynamics and they should be able to make use of their theoretical knowledge to solve practical problems associated with the topic of study. Examples of calculation familiarise them with hydrodynamic design calculations for devices with two- or multiphase flow.
Teaching methods:	Exercises 1 hour per week
Prerequisites	Knowledge aquired during the courses on *Flow Processes*, *Chemical Devices* and *Technical Documentation*
Assessment method:	Tests over the course of the semester
Name of lecturer:	
Contact person:	Dr inż. Aleksander Pabiś, tel. (12) 628 27 52, email; apabis@chemia.pk.edu.pl

		Multiphase flows – practical classes							
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	1	**15**		1				Z	

Module supervisor:

Course description:

Calculations of: resistance of one- and two-phase flow through packed columns, flooding velocity of the column, degree of liquid retention on the packing. Assignments concerning the hydrodynamics of tray columns. Determination of column packing characteristics: specific surface area of the packing, porosity, specific interfacial area, equivalent diameter of packing elements and of channels between them.

The following values are calculated in relation to fluidization and spouting processes: resistance generated by the moving bed flow and by the gas distributor, height of fluidized bed, minimum fluidization velocity and terminal settling velocity.

Examples of calculations related to bubbly and anular flow regime. Determination of gas bubble diameter and velocity, critical flow rate, specific interfacial area.

Use of Baker as well as Taitel and Dukler flow pattern maps in calculations of two-phase flows. Liquid-liquid flows. Calculation of pressure drop in hydraulic and pneumatic transport. Design calculations for devices used to separate solid particles

Education effects – learning and competences:

- Students know and understand basic laws governing multiphase flows.
- Students are aware of the reasons for implementing two- and multiphase flows.
- Students acquire basic theoretical and practical knowledge in the field of pneumatic and hydraulic transport.
- Students are able to conduct calculations for hydrodynamic column apparatuses (tray, packed, thin film flow, fluidization, spouted bed, extraction and bubble columns). They can perform basic calculations ensuring constant flow in hydraulic and pneumatic transport.

SUBJECTS OF EXERCISES

No.	Subject	Main issues	Number of hours
1	Flow resistance through fixed-bed packings.	Gaseous phase flow resistance through fixed-bed packings. Resistance in gas-liquid two-phase countercurrent flow. Calculations of the flooding velocity of the column. Characterization parameters of column packings.	**2**
2	Hydrodynamics of fluidization and spouted bed columns.	Determination of minimum fluidization velocity, terminal settling velocity, height of fluidized bed, as well as of fluidized bed and gas distributor generated flow resistance.	**2**
3	Separation of solid particles from liquid and gas.	Ranges of free and hindered settling. Calculations of sedimentation tank, cyclone and hydrocyclone dimensions.	**2**
4	Use of flow pattern maps in calculations of two-phase flows	Two-phase flow pattern maps. Characteristic flow areas. Example of calculation. Test number 1 covering the	**2**

	(gas-liquid and vapor-liquid). Test number 1.	material studied during exercises 1-3.	
5	Barbotage	Bubbly and anular flow regime. Calculation algorithm. Example of calculation.	**2**
6	Liquid-liquid two-phase flow. Thin film flow.	Liquid-liquid two-phase flow in extraction columns - example of calculation. Thin film flow on a vertical surface - example of calculation.	**2**
7	Hydrodynamics of hydraulic and pneumatic transport.	Flow resistance in hydraulic and pneumatic transport - example of calculation.	**2**
8	Test number 2.	Test number 2 covering the material studied during exercises 4-7.	**1**
	Total		**15**

Syllabus in English

COURSE TITLE:	**SI-2_07 - Multiphase Flows – projects**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	
Type of course:	Obligatory
Number of contact hours:	15

Semester of study:	1
ECTS credits:	
Course description:	The projects are aimed at broadening and practical application of the knowledge acquired during the lectures on *Multiphase Flows*. Two projects will be performed. In the first project, students calculate the pressure drop and the flooding velocity for several selected high efficiency wetted packings and compare the results with flow resistance through a layer of Rasching rings. The second project covers aerodynamic calculations for gas-solid fluidized bed columns. The following values are determined: minimum fluidization velocity, terminal settling velocity, pressure drop, optimal gas velocity, height of fluidized bed, as well as the amount of finest granular material carried upward through a column. Moreover, students calculate the basic dimensions of a cyclone used to collect solid particles carried upward through a column.
Recommended reading:	- Kembłowski Z., Michałowski S., Strumiłło Cz., Zarzycki R., Podstawy Inżynierii Chemicznej i Procesowej, Warszawa, 1985, WNT - Daraiswamy I.K., ujumdar A.S., Transport in Fluidized Particle Systems, Amsterdam, 1998, Elsevier - Ciesielczyk W., Kupiec K., Wiechowski A., Przykłady i Zadania z Inżynierii Chemicznej i Procesowej, Cz. 1 i 2, Kraków, 1989, Wydawnictwo Politechniki Krakowskiej - Praca pod redakcją Troniewskiego L., Tablice do Obliczeń Procesowych, Wyd.V, Opole, 2006, Oficyna Wydawnicza Politechniki Opolskiej - Billet R., Oszczędność Energii w Procesach Termicznego Rozdziały Substancji, Warszawa 1992, WNT
Educational effects:	The projects prepared within the framework of the course *Multiphase Flows* allow the students to use the knowledge and skills acquired during the lectures and exercises. Students learn the methodology for designing chemical devices and how to make use of diverse technical support, such as standards, catalogues and specialized computer programs. Students get aware of the fact that specialists from several scientific domains (Process engineering, Mechanical engineering, Control engineering, etc.) contribute to the creation of a complete project.
Teaching methods:	Projects 1 hour per week

Prerequisites	Knowledge acquired during courses on *Flow Processes* and *Chemical Devices*.
Assessment method:	Oral defence of completed projects.
Name of lecturer:	
Contact person:	Dr inż. Aleksander Pabiś, tel. (12) 628 27 52, email; apabis@chemia.pk.edu.pl

	SI-2_07 – Multiphase flows - projects								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	1	**15**					1	Z	

Module supervisor:

Course description:

In the first project, students calculate the flow resistance of one and two phases through several selected modern high efficiency packings, using equations available in literature. Moreover, they determine the following characteristics of the packing: specific surface area, porosity, specific interfacial area, equivalent diameter of packing elements and of channels between them. They also calculate the flooding velocity of the column and the degree of liquid retention on the packing. Finally, the results are compared with results obtained for a column packed with classical Rasching rings.

The second project covers aerodynamic calculations for gas-solid fluidized bed column. The following values are determined: minimum fluidization velocity, terminal settling velocity, pressure drop, optimal gas velocity, height of fluidized bed, as well as the amount of finest granular material carried upward through a column. Moreover, students calculate the basic dimensions of a cyclone designed to collect solid particles carried upward through a column.

Education effects – learning and competences:

- Students familiarize themselves with the methodology for designing devices used in technological processes.
- Students learn how to make practical use of the knowledge acquired in the course of lectures and exercises and how to look for information necessary to execute the projects.
- Students broaden their knowledge, especially in the field of modern packings and hydraulics of packed columns (Project number 1).
- In addition, students broaden their knowledge in the field of aerodynamics of columns with moving beds and become proficient in designing and selecting dust collectors, in particular cyclones (Project number 2).

PROJECTS

Framework program of assigned tasks

1. Distribution of tasks and data for the first project concerning the hydrodynamics of one- and two- phase countercurrent flow through a column for several selected modern packings.

Short theoretical introduction, information about the order of tasks to perform within the project and specification of requirements regarding editing and layout (2 hours).

2. Students determine the characteristics of selected modern packings: specific surface area, porosity, specific interfacial area, equivalent diameter of packing elements and of channels between them. They calculate the flow resistance for those packings using equations available in literature (Ergun, Todes, Żaworonkow). They also calculate the flooding velocity of the column and the degree of liquid retention on the packing. They perform analogical calculations for classical Rasching rings and compare the results (3 hours).

3. The results are presented in the form of graphs:

- where the pressure drop Δp is a function of the variable gaseous phase flow rate; the calculations are made for several indicated countercurrent liquid flow rates.

- where the pressure drop Δp is a function of the variable gaseous phase flow rate; the calculations are made using various equations for one selected liquid flow rate (1 hour).

4. First project submission and its oral defence (1 hour).

5. Distribution of tasks and data for the second project concerning the aerodynamics of a gas-solid fluidization column. Short theoretical introduction, information about the order of tasks to perform within the project and specification of requirements regarding editing and layout (2 hours).

6. Students calculate and determine the values of: minimum fluidization velocity, terminal settling velocity, pressure drop, optimal gas velocity, height of fluidized bed and the amount of finest granular material carried upward through a column. Moreover, they calculate the basic dimensions of a cyclone designed to collect solid particles carried upward through a column. Finally, they determine the basic parameters of the column: the height of individual zones and its diameter.

7. Execution of a tender drawing of the designed column, indicating basic dimensions and construction details requested by the lecturer.

8. Second project submission and its oral defence (1 hour).

Syllabus in English

COURSE TITLE:	**Non-conventional liquid mixture separation**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	SI-2/8
Type of course:	Obligatory
Number of contact hours:	30
Semester of study:	1
ECTS credits:	2
Course description:	Thermodynamical analysis of mixture separation. General characteristics of liquid mixture separation methods. Permeation processes. Theoretical basics of osmotic equilibrium. Membrane processes: distribution characteristic and application. Membrane surface modification for liquid separation. Biological methods: general characteristics; bioseparation, miscellaneous

	bioseparation processes. Properties of biological material, mass transfer, cell disruption, centrifugation, ultracentrifugation, extraction (conventional, ultrasonic aided and in supercritical conditions), mass transfer. Modeling of technical systems. Mathematical and computer aided methods.
Recommended reading:	Hoffman E.J. Membrane separation Technology, Gulf PP, 2003. Perry's Chemical Engineers Handbook (7th ed.), McGraw-Hill, New York, 1997.
Educational effects:	Student knows methods of liquid systems separation and purification, with the special emphasis on bioseparation and extraction methods. Student knows how to choose appropriate methods to the specific mixture types. Student is able to model mass transport in the learned methods of separation. Student knows how to model the removal of toxic substances in the activated sludge process.
Teaching methods:	Lectures 1h, Project 1h
Prerequisites	B.Sc. degree In chemical engineering or similar field
Assessment method:	Attendance, written test and project
Name of lecturer:	Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc.,
Contact person:	Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc., 12 6282739, email: btfigiel@pk.edu.pl

kod	Non-conventional liquid mixture separation								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		

Module supervisor: Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc.,

Course description:

Thermodynamical analysis of mixture separation. General characteristics of liquid mixture separation methods. Permeation processes. Theoretical basics of osmotic equilibrium. Membrane processes: distribution characteristic and application. Membrane surface modification for liquid separation. Biological methods: general characteristics; bioseparation, miscellaneous bioseparation processes. Properties of biological material, mass transfer, cell disruption, centrifugation, ultracentrifugation, extraction (conventional, ultrasonic aided and in supercritical conditions), mass transfer. Modeling of technical systems. Mathematical and computer aided methods

Education effects – learning and competences: Student knows methods of liquid systems separation and purification, with the special emphasis on bioseparation and extraction methods. Student knows how to choose appropriate methods to the specific mixture types. Student is able to model mass transport in the learned methods of separation. Student knows how to model the removal of toxic substances in the activated sludge process.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	**Introductory information**	**Thermodynamic analysis of the separation of mixtures. General characteristics of the liquid mixtures separation methods.**	**3**
2	**Membrane processes**	**Basic processes and purification degrees achieved in them. Permeation processes. Theoretical basis of osmotic balance. Membrane processes: classification, characterization and application. Membrane surface modification for liquid separation.**	**4**
3	**Biological separation methods**	**Biological methods: general bioseparation characteristics, micellar bioseparation processes. Biological material properties, mass**	**5**

		transfer-cell destruction, centrifugation (ultracentrifugation) extraction (classic, using ultrasound and supercritical conditions), mass transfer.	
4	**Mathematical modeling**	**Modeling of technical systems: Computer aided mathematical methods.**	**3**

PROJECTS

The Work Programme Framework

1. Modeling of mass transport in the extraction process -- classical and with the ultrasonic field.

2. Modeling of the toxic substances removal in the active sludge process.

Syllabus in English

COURSE TITLE:	BIOREACTORS
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	SI-2/14
Type of course:	Obligatory
Number of contact hours:	60 h (lectures 30 h, exercises 15 h, projects 15 h)
Semester of study:	Semester II/1
ECTS credits:	5
Course description:	Microbiological and enzymatic processes in biotechnology. Classification of bioprocesses. Stoichiometry and kinetics of biotransformations. Types of bioreactors. Continuous and batch tank bioreactors. Design methods of tank bioreactors and their cascades. Analysis of bioreactor dynamics. Bubble reactors and fluidized bed reactors for aerobic processes. Enzymatic processes. Characteristics of membrane bioreactors. Design solutions of biochemical reactors: tank bioreactors, column bioreactors for aerobic processes, plate column and fluidized bed reactors, airlift reactors. Hollow-fibre bioreactors.
Recommended reading:	- I.J. Dunn, E. Heinzle, J. Ingham, J.E. Prenosil, Biological reaction engineering, Wiley, Weinheim 2003 - J.E.Bailey, D.F.Ollis, Biochemical engineering fundamentals, McGraw-Hill, New York 1986. - S.Aiba, A.E.Humphrey, N.F.Millis, Biochemical engineering, Academic Press, New York 1973. - B. Tabiś, R. Grzywacz, Procesy i reaktory biochemiczne, Wyd. Politechniki Krakowskiej, Kraków 1993. - J. Bałdyga, M. Henczka, W. Podgórska, Obliczenia w inżynierii bioreaktorów, Oficyna Wydawnicza Politechniki Warszawskiej 1996. - M.L. Shuler, F. Kargi, Bioprocess Engineering: Basic Concepts, Prentice Hall, New Jersey 1992.
Educational effects:	Understanding the principles of processes occurring in biochemical reactors of various types. Ability to formulate mathematical models of processes occurring in basic types of

	bioreactors. Choice of proper types and design of biochemical reactors for selected processes of industrial significance. Assessment of process safety for bioreactors. Skill in methods of solutions of nonlinear equations describing bioreactors with lumped state variables. Assessment of steady states stability in continuous stirred tank bioreactors.
Teaching methods:	Lecture – 2h / week Exercises – 1h/week Project – 1h / week
Prerequisites	Courses: Mathematics, Chemical engineering, Chemical reactors engineering, Numerical methods. Skills: Computer literacy; programming in selected high-level language e.g.: Fortran, basic knowledge of Matlab.
Assessment method:	Written exam
Name of lecturer:	Szymon Skoneczny
Contact person:	Szymon Skoneczny, MEng., 608 088 438, skoneczny@indy.chemia.pk.edu.pl

SI-2/13			Bioreactors							
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	2	**60**	2				2	E	**4**

Module supervisor: Szymon Skoneczny, M.Sc.

Course description:

Microbiological and enzymatic processes in biotechnology. Economical and social importance of biotechnological processes. Characteristics and classification of bioprocesses. Stoichiometry and kinetics of microbiological processes. Structured and unstructured kinetic models of microbiological processes. Experimental methods in microbiological kinetics research. Types of bioreactors. Batch bioreactors. Stationary properties of continuous stirred tank microbiological reactors. Steady states nonlinear characteristics of microbiological stirred tank reactors. Biochemical cascades with biomass recirculation. Microbiological processes with two trophic levels. Analysis of bioreactor dynamics. Continuous bubble reactors and fluidized bed reactors for aerobic processes. Enzymatic processes. Immobilization engineering of enzymes and microorganisms. Effect of biofilm presence on characteristics of bioreactors. Characteristics of membrane bioreactors. Design solutions of biochemical reactors: stirred tank bioreactors, bubble column bioreactors for aerobic processes, plate column and fluidized bed reactors, airlift bioreactors. Rotary bioreactors. Membrane

Education effects – learning and competences:

Understanding the principles of processes occurring in biochemical reactors of various types. Ability to formulate mathematical models of processes occurring in basic types of bioreactors. Choice of proper types and design of biochemical reactors for selected processes of industrial significance. Assessment of process safety for bioreactors. Skill in methods of solutions of nonlinear equations describing bioreactors with lumped state variables. Assessment of steady states stability of continuous stirred tank bioreactors. Skill in methods of developing biofilm models and biofilm reactors.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	Introduction to microbiological processes	Technical and economical importance of biotechnological processes and bio-engineering. Classification of bioprocesses and their characteristics.	**2**
2	Stoichiometry of microbiological processes	Manner of stoichiometric equations notation. Application of stoichiometric equations for mass balances and kinetic equations.	**2**
3	Kinetics of bioprocesses	Rate of a microbiological process. Kinetic models of microbiological processes. Unstructured and structured models of microbiological processes. Kinetics of substrates utilization and biomass growth. Yield coefficients. Experimental methods in kinetic	**2**

		research of microbiological processes.	
4	Batch tank reactors	Mass balances of batch reactor. Mathematical modelling of batch reactors dynamics. Design of batch reactors.	**2**
5	Continuous stirred tank bioreactors	Design of continuous flow bioreactors. Steady-state properties of continuous flow bioreactors. Single- and multi-substrate processes. Nonlinear characteristics of steady-states of tank bioreactors. Phenomenon of biomass washout and its influence on process safety.	**4**
6	Cascades of continuous stirred tank bioreactors	Modelling of biochemical cascades. Simple cascades without recirculation. Biochemical cascades with recirculation and thickening of biomass. Comparison of steady-state characteristics of cascades with single reactors. Influence of distribution of reactors volumes and recirculation of biomass on position of steady-state branches.	**2**
7	Microbiological processes with two species of microorganisms	Co-existence of different microbiological species in a continuous stirred tank bioreactor. Microbiological process with double trophic chain. Existence and significance of predator-prey processes on biodegradation. Steady-state and dynamic characteristics of continuous stirred tank bioreactor for predator-prey processes.	**2**
8	Continuous flow bubble bioreactors and fluidized bed bioreactors for aerobic processes	Modelling method of bubble bioreactors, allowance for kinetics of mass transfer and hydrodynamics of two-phase and three-phase systems. Design of bubble bioreactors and fluidized bed bioreactors for aerobic processes.	**4**
9	Modeling of biofilms and biofilm reactors	Methods allowing for presence of biofilm in bioreactors. Classification of biofilms and their models. Characteristics of	**4**

		bioreactors with wall growth.	
10	Enzymatic processes and reactors	Characteristics of enzymatic processes. Enzyme immobilization engineering. Types, properties and method of membrane bioreactor modelling.	**2**
11	Design solutions of bioreactors	Design solutions of biochemical reactors: tank bioreactors, column bioreactors for aerobic processes, plate column and fluidized bed reactors, airlift reactors. Membrane reactors for enzymatic processes. Hollow-fibre bioreactors.	**4**

SUBJECTS OF EXERCISES

No.	Subject	Main issues	Number of hours
1	Stoichiometry of microbiological processes	Notation of stoichiometric equations of microbiological processes. Calculating masses of generated products and process productivity and use of balance of elements in calculations.	**2**
2	Kinetics of bioprocesses	Calculating biotechnological processes rate by various kinetic dependences. Determining change of composition of microorganisms and adaptation of microorganisms. Calculating microorganisms' age distribution in the population.	**2**
3	Determination of kinetic parameters of chosen bioprocesses	Determining kinetic parameters of enzymatic process and microbiological processes occurring according to Monod and Haldane kinetic.	**2**
4	Batch tank bioreactors	Deriving balances equations of batch tank bioreactor. Determining time of reaction, concentrations of substrates, products and biomass.	**2**
5	Continuous stirred tank bioreactors	Calculations of dynamics of single- and multi-substrate processes. Determining the steady-state and defining its stability. Calculating washout time of microorganisms and determining influence of this phenomenon on process safety.	**2**
6	Cascades of continuous stirred tank biochemical reactors	Balancing cascade of bioreactors with recirculation and biomass densification. Determining the influence of volumes distribution and recycle of biomass on position of steady-states branches.	**2**
7	Microbiological processes with two species of microorganisms	Deriving mathematical predator-prey model. Model transformation to dimensionless form.	**1**

8	Modeling of biofilms and biofilm reactors	Analytical methods of calculating biofilm thickness. Determining effectiveness factor of biofilm. Rate of process with immobilization of microorganisms.	**2**

PROJECTS

The Work Programme Framework

1. **Technological analysis of chosen biotechnological processes.**

   In the project student is obligated to describe in detail individually chosen biotechnological process and perform its technological analysis. The description should take into account technological scheme, process conditions and species of microorganisms used. Additional element is to find kinetic equations of the process. Within a framework of technological analysis student interprets technological scheme, reasons the choose of bioreactor type and perform the assessment of process and products significance.

   The project also consists of: justification of choosing the process, conclusions and quoted literature.

2. **Kinetic analysis of chosen microbiological processes.**

   The goal of the project is determination of kinetic equation of microbiological process occurring according to unstructured model. The basis for the determination of kinetic equation are experimental results, which student receives from the tutor.

   Task of student is both proposing the form of kinetic equation and determination of kinetic parameters in this equation. For the determination of kinetic constants it is necessary to use chosen minimizing method, and the choice should be justified.

   Within a framework it is also necessary to: elaborate numerical algorithm, create computer program, execute and describe calculations and draw conclusions. Additionally the project consists of list of quoted literature.

3. **Evaluation of work conditions of cascade of two tank bioreactors with partial recirculation and determination of productivity and stability of cascade work in steady state.**

Biodegradation of toxic carbonaceous compound proceeded in a cascade of two continuous tank bioreactors with perfect mixing with partial recirculation of flow is the subject of the project. The task is to evaluate steady state of the cascade and to determine its stability.

Kinetic parameters of the microbiological process and process parameters: concentration of substrate in feed flow of the cascade, residence time of liquid in the object, reactors volumes distribution coefficient and the degree of biomass recirculation are the data for the project.

In order to calculate state variables determining steady state student needs to formulate the mathematical model of the cascade and convert to dimensionless form, and solve obtained set of algebraic nonlinear equations by using self-written computer programme or computing environment. The stability should be determined by calculating the eigenvalues of Jacobian matrix of right-hand sides of model equations. Writing own programme is the basis to increase the grade.

The project consists of: derivation of the model and conversion to dimensionless form, way of reasoning and intermediate results, scheme of installation, conclusions and quoted literature.

Syllabus in English

COURSE TITLE:	Mixing Processes in Technology
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	SI-2-14
Type of course:	Obligatory
Number of contact hours:	30
Semester of study:	1
ECTS credits:	2
Course description:	Introduction to balancing and modeling mixing processes. Methods of solution boundary problems using mechanical and ultrasonical mixing as examples. Mechanisms, hydrodynamics, mechanics of mixing. Kolmogorov theory. Intermittence. Experimental measurements of droplet (bubbles) diameters and interfacial area. Power consumption in liquid mixing. Influence of geometric and process as well as physicochemical parameters on the process. Energy and mass transport in fluid mixtures. Mixing of granular materials.
Recommended reading:	Harnby N., Edwards M.F., Nienow A.W., Mixing in the Process Industries, Butterworth-Heinemann, Oxford, 1992. Perry's Chemical Engineers Handbook (7th ed.), McGraw-Hill, New York, 1997. Zlokarnik M., Stirring Theory and Practice, Wiley-VCH, Weinheim, 2001. Paul E.L., Atiemo-Obeng V.A., Kresta S.M, Handbook of industrial mixing : science and practice, Wiley-Interscience, Hoboken, 2004.
Educational effects:	Student is able to describe models of mixing processes. Student is able to solve initial-boundary problems concerning mixing hydrodynamics. Student knows how to solve problems of mixing real fluids. Student is able to describe basic parameters, occurring in the

	processes of mixing various media.
Teaching methods:	Lectures 1h, Exercises 1h
Prerequisites	B.Sc. degree In chemical engineering or similar field
Assessment method:	Attendance, written test and project
Name of lecturer:	Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc.,
Contact person:	Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc., 12 6282739, email: btfigiel@pk.edu.pl

SI-2/14	Mixing in Technological Processes								
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	1	**30**	1	1				S	

Module supervisor: Barbara TAL-FIGIEL, Ass.Prof., Ph.D., D.Sc.,
Introduction to balancing and modeling mixing processes. Methods of solution boundary problems using mechanical and ultrasonic mixing as examples. Mechanisms, hydrodynamics, mechanics of mixing. Kolmogorov theory. Intermittence. Experimental measurements of droplet (bubbles) diameters and interfacial area. Power consumption in liquid mixing. Influence of geometric and process as well as physicochemical parameters on the process. Energy and mass transport in fluid mixtures. Mixing of granular materials.

Education effects – learning and competences:

Student is able to describe models of mixing processes.

Student is able to solve initial-boundary problems concerning mixing hydrodynamics.

Student knows how to solve problems of mixing real fluids.

Student is able to describe basic parameters, occurring in the processes of mixing various media.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	Introduction to balancing and modeling of mixing processes	Basic definitions. Types of mixing processes. Mixing quality criteria..	2
2	Methods of solution of initial-boundary problems for the case of mechanical mixing.	Mixing power consumtion, hydrodynamics, types of stirrers.	4
3	Methods of solution of initial-boundary problems for the case of ultrasonication.	Influence of physicochemical parameters on the hydrodynamics and mass transfer kinetics.	4
4	Mass and momentum transfer in the liquid mixers.	Criterial equations for the mass and energy transfer in mixers of various types.	2
5	Mixing of granular materials.	Mechanics of particular matter, types of mixers, phenomena occuring during the mixing.	3

SUBJECTS OF EXERCISES

No.	Subject	Main issues	Number of hours
1	Introduction to balancing and modeling of mixing processes	Basic variables and non-dimensional numbers in the mixing processes. Laminar and turbulent mixing.	2
2	Methods of solution of initial-boundary problems for the case of mechanical mixing.	Mixing hydrodynamics. Kinetic of heat and mass transport in mechanical mixers. Solution methods of the initial-boundary problem.	4
3	Methods of solution of initial-boundary problems for the case of ultrasonication.	Mixing hydrodynamics. Kinetic of heat and mass transport in ultrasonic mixers. Solution methods of the initial-boundary problem	4
4	Mass and momentum transfer in the liquid mixers.	Mechanism of mass and energy transfer in mixers. Criterial equations.	2
5	Mixing of granular materials.	Basic parameters describing shape and size of granular particles. Mixing mechanisms.	3

Syllabus in English

COURSE TITLE:	**Pumps and fans**
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	
Type of course:	Obligatory
Number of contact hours:	30
Semester of study:	1
ECTS credits:	
Course description:	Classification of pumps and fans. Theoretical fundamentals of operation of centrifugal pumps and centrifugal fans. Performance curves of centrifugal pumps and fans. Operation of centrifugal pumps and fans in technological plants. Rules of selection of centrifugal pumps and fans to industrial plants.
Recommended reading:	- W. Jędral, *Pompy wirowe,* PWN, Warszawa, 2001. - A. Korczak, J. Rokita, *Pompy i układy pompowe*, Skrypt Politechniki Śląskiej, Gliwice, 1985. - F. Jankowski, *Pompy i wentylatory w Inżynierii sanitarnej*, Arkady, Warszawa, 1970. - S. Fortuna, *Wentylatory,* Techwent, Kraków, 1999. - T. Fodemski, *Pomiary cieplne, część II - Badania cieplne maszyn i urządzeń*, WNT, Warszawa, 2001. - L. R. Couper, W. R. Penney, J. R. Fair, S.M. Walas, *Chemical Process Equipment, Selection and Design,* Elsevier, 2005. - R. Turton et al., *Analysis Synthesis and Design of Chemical Processes,* 2nd edition, Prentice Hall, Upper Saddle River, New Jersey 2003 - A. K. Coker, *Ludwig's applied process design for chemical and petrochemical plants,* Vol. 1, Elsevier, Amsterdam, 2007. - I. J. Karassik, *Pump handbook*, 3rd edition, Mc Graw-Hill,

	2001. - M. W. Volk, *Pump characteristics and application,* 2nd edition, Taylor & Francis, 2005. - F. P. Bleier, *Fan handbook: selection, application and design,* Mc Graw Hill, 1998.
Educational effects:	Learning and understanding the problems connected with the transport of liquids and gases in industrial plants and with transport equipment. Knowledge of principles of operation of pumps and fans. Skills at selection of pumps and fans. Competences in designing industrial plants for transport of liquids and gases.
Teaching methods:	Lectures – 2h/week
Prerequisites	Fluid flow processes, Chemical process equipment.
Assessment method:	Tests and written exam.
Name of lecturer:	
Contact person:	Dr inż. Tadeusz Komorowicz, tel. (12) 628 27 52; e-mail: tkomorow@chemia.pk.edu.pl Dr hab. inż. Andrzej Laszuk, Prof. PK, tel. (12) 628 27 37, e-mail: alaszuk@chemia.pk.edu.pl

kod			Pumps and fans							
Year	Semester	Hours in semester	Course type(hours per week)						Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project			
1	1	**30**	30						E	

Module supervisor:

Course description:

Classification of pumps. Centrifugal, piston and jet pumps. Theoretical fundamentals of operation of centrifugal pumps.

Performance curves of head, power and efficiency as functions of flow rate for centrifugal pumps. Operation of centrifugal pumps in technological plants. Control of operational pump parameters.

Classification of fans. Centrifugal fans. Theoretical fundamentals of operation of centrifugal fans.

Performance characteristics of centrifugal fans. Fans of special application. Operation of centrifugal fans in technological plant.

Rules of operational use of pumps and fans. Rules of selection of centrifugal fans and pumps to industrial plants.

Education effects – learning and competences:

Learning and understanding the problems connected with the transport of liquids and gases in industrial plants and with transport equipment. Knowledge of principles of operation of pumps and fans. Skills at selection of pumps and fans. Competences in designing industrial plants for transport of liquids and gases.

SUBJECTS OF LECTURES

No.	Subject	Main issues	Number of hours
1	Pumps	Classification and basic principles of operation.	**2**
2	Pumps and pumping systems	Parameters describing operation of pump and pumping system. Energy losses and pump efficiency.	**2**
3	Piston pumps	Piston pumps, types of piston pumps. Capacity of piston pump.	**2**
4	Centrifugal pumps	Classification of centrifugal pumps. Theoretical principles of operation of centrifugal pumps.	**2**
5	Operational parameters of centrifugal pumps	Performance curves of head, power and efficiency as functions of flow rate for centrifugal pumps. Maximum suction head, cavitation.	**2**

6.	Jet pumps	Principle of operation of jet pump. Performance characteristics.	**2**
7	Centrifugal pumps and pumping system (1)	Operation of centrifugal pump in pumping system. Operational point. Control of operational pump parameters. Pumps in connection. Examples of pumping systems.	**3**
8	Centrifugal pumps and pumping system (2)	Rules of selection of centrifugal pump to technological plant. Rules of operational use of pumps.	**2**
9	Fans	Classification and principles of operation of fans.	**2**
10	Centrifugal fans (1)	Pressure distribution in suction and discharge piping. Theoretical fundamentals of operation of centrifugal fans.	**3**
11	Centrifugal fans (2)	Operational parameters of fans. Power output and kinds of energy losses. Control of flow rate.	**2**
12	Centrifugal fans and technological plant (1)	Performance characteristics of fans. System characteristic. Operating point of fan. Rules of selection of centrifugal fan to technological plant.	**2**
13	Centrifugal fans and technological plant (2)	Fans in connection. Rules of operational use of fans. Explosion-proof fans, fans for hot gases.	**2**
14	Investigations of pumps and fans	Basic rules of investigations of operational parameters of centrifugal pumps and fans.	**2**

Syllabus in English

COURSE TITLE:	PUMPS AND FANS
Institute/Division:	Institute of Chemical and Process Engineering
Course code:	
Type of course:	Obligatory
Number of contact hours:	30
Semester of study:	1
ECTS credits:	
Course description:	Practical application of earned knowledge to: • process calculations and design of fluid flow installations for liquids and gases, • interpretation of performance characteristics of pumps and fans offered by producers.
Recommended reading:	- W. Jędral, *Pompy wirowe,* PWN, Warszawa, 2001. - A. Korczak, J. Rokita, *Pompy i układy pompowe*, Skrypt Politechniki Śląskiej, Gliwice, 1985. - F. Jankowski, *Pompy i wentylatory w Inżynierii sanitarnej*, Arkady, Warszawa, 1970. - S. Fortuna, *Wentylatory,* Techwent, Kraków, 1999. - T. Fodemski, *Pomiary cieplne, część II badania cieplne maszyn i urządzeń*, WNT, Warszawa, 2001. - K. F. Pawłow, P. G. Romankow, A. A. Noskow, *Przykłady i zadania z zakresu aparatury i inżynierii chemicznej,* WNT, Warszawa, 1973. - L. R. Couper, W. R. Penney, J. R. Fair, S. M. Walas, *Chemical Process Equipment, Selection and Design,* Elsevier, 2005. - R. Turton et al., *Analysis Synthesis and Design of Chemical Processes,* 2nd edition, Prentice Hall, Upper Saddle River, New Jersey 2003 - A. K. Coker, *Ludwig's applied process design for chemical and petrochemical plants,* Vol. 1, Elsevier, Amsterdam, 2007.

	- I. J. Karassik, *Pump handbook*, 3rd edition, Mc Graw-Hill, 2001. - M. W. Volk, *Pump characteristics and application,* 2nd edition, Taylor & Francis, 2005. - F. P. Bleier, *Fan handbook: selection, application and design,* Mc Graw Hill, 1998.
Educational effects:	Competences in: • constructing diagrams of fluid flow installations for liquids and gases, • conducting process calculations aimed at selection of pumps and fans, • technical and economic analyzing offers of producers of pumps and fans.
Teaching methods:	Project – 2h/week
Prerequisites	Fluid flow processes, Chemical process equipment.
Assessment method:	Assessment of performed projects.
Name of lecturer:	
Contact person:	Dr inż. Tadeusz Komorowicz, tel. (12) 628 27 52; e-mail: tkomorow@chemia.pk.edu.pl

kod			**Process design - project**						
Year	Semester	Hours in semester	Course type(hours per week)					Assessment method	ECTS credits
			Lect.	Ex	Seminar	Lab/CL	Project		
1	1	30					30	A	

Module supervisor:

Course description:

Project 1. Project of pump system.

Construction of a diagram of technological plant. Balance of liquid flow. Calculations of pressure losses in plant. Calculations of maximum suction head. Selection of pump on the base of offers of producers. Determination of operating point for centrifugal pump. Analysis of performance characteristics.

Project 2. Project of technological plant with centrifugal fan.

Construction of a diagram of technological plant. Selection of fan system for plant with variable pressure gas tanks. Calculations of pressure losses in plant and output power of fan. Selection of fan on the base of offers of producers. Determination of operating point for centrifugal fan. Analysis of the fan capacity control range.

Education effects – learning and competences:

Competences in:

- constructing diagrams of fluid flow installations for liquids and gases,
- conducting process calculations aimed at selection of pumps and fans,
- technical and economic analyzing offers of producers of pumps and fans.

Courses in English offered at the Faculty of Chemical Engineering and Technology, Cracow University of Technology

SPRING SEMESTER

L = Lectures; E = Exercises; S = Seminar; lab = laboratory; P = Project

Core courses for students specializing in Chemical Engineering (M.S. program):

Course name	**Lecturer/Module Director**	Number of classes (45 min each)											*ECTS points*
		E - module with final exam						Spring semester (Febuary-June) [hours/week]					
		Total	L	E	S	lab	P	L	E	S	lab	P	
Process Dynamics	P.Ptaszek (adiunkt)	60	30	15	0	0	15	E 2E	1			1	*5*

Modelling of energy, mass and momentum transfer	B.Tal-Figiel (prof. PK), W.Figiel (adiunkt)	30	15		0	0	15	1				1	*2*
Multiphase Flows	B.Tal-Figiel (prof. PK), W.Figiel (adiunkt)	60	30	15	0	0	15	**E** 2	1			1	*4*
Calculational Methods in Chemical Engineering I	K.Kupiec (prof. PK), M.Gwadera (assistant)	30	15		0	15	0	1			1		*2*
Non-conventional Liquid Mixture Separation	B.Tal-Figiel (prof. PK), W.Figiel (adiunkt)	30	15		0	0	15	1				1	*2*
Chemical Technology II	K.Porzycka-Semczuk (adiunkt), K.Gorazda (adiunkt)	45	45		0	0	0	3					*3*
Specialty courses: Engineering of Technological Processes													
Biochemical Reactors Engineering	B.Tabiś (Prof.), S.Skoneczny (assistant)	60	30	0	0	0	30	**E** 2				2	*4*
Mixing in Technological Processes	B.Tal-Figiel (prof. PK), W.Figiel (adiunkt)	45	30	0	0	0	15	2				1	*4*
High-efficiency Heat and Mass Exchangers*	A.Pabiś (adiunkt)	60	30	0	0	0	30	**E** 2				2	*6*

*Optional General Courses (selectable)***													
Applications of Neural Networks	B.Fryźlewicz-Kozak (adiunkt)	30					30					2	*2*
Storage, Transport and Distribution	K.Porzycka-Semczuk (adiunkt)	30	30					2					*2*
Remediation of Polluted Soils	K.Porzycka-Semczuk (adiunkt)	15	15					1					*1*
Air Protection	K.Porzycka-Semczuk (adiunkt)	15	15					1					*1*
Designing of Functional Molecular Systems	P.Romańczyk (adiunkt)	15	15					1					*1*
Novel Media for Chemical Processes	S.Kurek (adiunkt)	15	15					1					*1*

*) starting since spring semester of 2013/2014

**) these courses are selectable (i.e., they will run only if selected by entire student group)

Faculty of Environmental Engineering

COURSE TITLE: **INTRODUCTION TO EMERGY ANALYSIS**

Institute/Division: Institute of Water Supply and Environmental Protection, Chair of Environmental Technologies

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The main goals of the course are following: to teach students the principles and practices of quantitative methods for the evaluation of environmental impacts and analysis of carrying capacity of economic development, and interactions of ecological and economical systems. As a result of teaching, students will be able to build the system analysis models, simulate them and analyze the results. The lecture topics include: energy and its hierarchy, environmental production and economic use, energy memory, energy quality, energy transformation, evaluation of environmental resources, energy of states and nations, environmental accounting, principles of system analysis and visualization of a system, evaluating international exchange evaluation of alternatives for development.

Literature: Odum, H.T.. 1996. " Environmental Accounting". John Wiley &Sons;
Odum,H.T., and E.C.Odum. 2000 "Modeling for All Scales". Academic Press. San Diego
Also copies of the articles will be provided before some lectures meetings.

Course type: Lectures, design exercises, laboratory

Assessment method: Final test (70%), exercises (20%), attendance (10%)

Prerequisites: Chemistry, biology and ecology

Primary target group:	2nd year students in Environmental Engineering programme, BSc(Undergraduate)
Lecturer:	Włodzimierz Wójcik, Professor
Contact person:	Włodzimierz Wójcik, Professor, phone #: +48 12 628 21 82; e-mail: wwojcik@pk.edu.pl
Deadline for application:	1st February 2014

COURSE TITLE: **ON-SITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS**

Institute/Division: Institute of Water Supply and Environmental Protection, Chair of Environmental Technologies

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The main goals of the course are following: to teach students understanding of interactions of the ecological systems with the pollutants, and principles of designing, construction and operation of onsite wastewater systems. As a result of teaching, students will be able to design and operate such systems. The lecture topics include: natural and constructed wetlands, mechanisms of wastewater treatment, media characteristics, role of the vegetation , hydrological balance on the wetlands, land treatment of wastewater, slow rate systems, rapid infiltration systems; design criteria, pre-treatment requirements, systems configuration, design procedures and criteria, site evaluation procedures, operation problems.

Literature: Kadlec R.H. and Knight R.L. ”Treatment wetlands” . Lewis Publishers.
Odum,H.T., and E.C.Odum. 2000 "Modeling for All Scales". Academic Press. San Diego.
US EPA “Onsite Wastewater Treatment and Disposal Systems. Design Manual”.

Course type: Lectures, design exercises

Assessment method: Final test (70%), exercises (20%), attendance (10%)

Prerequisites: Chemistry, biology and ecology, engineering geology and hydrogeology, fluid mechanics

Primary target group: 3rd year students in Environmental Engineering programme, BSc(Undergraduate)

Lecturer: Włodzimierz Wójcik, Professor

Contact person: Włodzimierz Wójcik, Professor, phone #: +48 12 628 21 82;
e-mail: wwojcik@pk.edu.pl

Deadline for application: 1st February 2014

COURSE TITLE: **COMPUTER METHODS IN WATER AND GEOTECHNICAL ENGINEERING**

Institute/Division: Institute of Geotechnics

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: Knowledge of theoretical basis and practical skills in applying FEM in analysis of problems of water engineering including soil structures. Ability to use Z_Soil FEM code for analysis of static, stability and transient filtration in geotechnical systems. The lectures topics will include: review of matrix notation; mechanics of continuum and filtration – physical basis and boundary value problems in variational and matrix form; basis of finite element method; FE for statics of continuum; finite elements for nonlinear and transient problems; simple soil models; elastoplastic analysis and its finite elements implementation; load capacity and stability analysis in FE; finite elements in transient filtration problem.

Literature: Zienkiewicz O.C. “Finite element methods”,
Z_SOIL.PC User manual,
Materials available at the Institute’s web page.

Course type: Lectures, exercises, laboratory

Assessment method: Preparation and oral presentation of reports from performed simulation (factor 0,4)
Test on lecture content (oriented on practical aspects of considered problems), (factor 0,6)

Prerequisites: Strength of materials, soil mechanics, numerical methods

Primary target group: 3rd year students in Environmental Engineering programme, BSc(Undergraduate)

Lecturer: Aleksander Urbański, Professor

Contact person: Aleksander Urbański, Ph.D., phone #: +48 12 628-2823; e-mail: aurbansk@usk.pk.edu.pl

Deadline for application: 1st February 2014

COURSE TITLE: **ENVIRONMENTAL DECISION-MAKING**

Institute/Division: Institute of Water Supply and Environmental Protection, Chair of Water Supply, Sewerage and Environmental Monitoring

Erasmus subject code: 06.9 Engineering, Technology

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The main purpose of the course is to give a general knowledge on tools available for incorporating environmental costs and considerations into decision making in industry and in designing, operating and managing municipal water enterprises. The lectures will cover the following topics: tools for decisions screening, categories of environmental impact, qualitative and quantitative information, spread, assessment and pedigree of available environmental data, methods of cost estimation, generation of financial indicators, Life Cycle Assessment as a tool for improving environmental impact of gods, stages of a product life, economical tools in efficient distribution of investments for protection of environment, comparing different products in respect to their environmental impact, idea of a stack market for pollution, simple elements of optimization methods applied to environmental decision making, most current trends in municipal utilities designing methods reducing the impact of urbanization of floods ands urban water quality, Environmental liabilities such as compliance, remediation obligations, fines and penalties, compensations, and payment for natural resource damages.

Literature:

Ciechanowski P., Dąbrowski W., Environmental product Declaration – practical implementation of ISO14025 Technical Report 1st International Conference on Cycle Management, Copenhagen, Sierpień 27-29,2001, 141-144
Helby P., EKO-Energi – a public voluntary programme targeted at Swedish firms with ambitious environmental goals, Journal of Cleaner Production, 2002,10,129-141
Rettergen M.G., Farla J.C.M., Blok K., Do agreements enhance energy efficiency improvement? Analysing the actual outcome of long – term agreements on industrial

energy efficiencies improvement in the Netherlands, ibid. 10,2001,153-163

Course type:	Lectures, exercises
Assessment method:	Exercises, final conversation
Primary target group:	2nd year students in Environmental Engineering programme, BSc(Undergraduate)
Lecturer:	Wojciech Dąbrowski, Professor
Contact person:	Michal Zielina, Ph.D.(Eng.) , phone #: +48 12 628-28-36; e-mail: mziel@vistula.wis.pk.edu.pl
Deadline for application:	1st February 2014

COURSE TITLE:	**WATER AND WASTEWATER PROCESS TECHNOLOGY**
Institute/Division:	Institute of Water Supply and Environmental Protection, Chair of Environmental Technologies
Erasmus subject code:	06.9 Engineering, Technology
Number of contact hours:	30
Course duration:	1 semester (Spring)
ECTS credits:	2
Course description:	The module is designed as a tool for understanding the principles of basic technological processes, which are a part of recent advances in water and wastewater treatment as well as others that take place within water and sewer lines. The module broads students' general knowledge on environmental chemistry, introducing, at the same time, some specific biochemical and physical processes occurring in water and wastewater technology. This way, the module sequence comprising: Environmental Chemistry, Unit Processes in Water and Wastewater Treatment Technologies and Water and Wastewater Treatment constitutes an integral unit, focusing on identification, understanding and application of water and wastewater treatment processes. Judging from the previous experiences on module implementation, such approach seems to be the most appropriate way of transfer from the environmental chemistry issues to the water and wastewater treatment problems. Moreover, the students who had finished the module and choose to specialize in other areas will have a sufficient theoretical background to continue their further education in the field of water supply and wastewater treatment.
Literature:	Barrow G. M.: Physical chemistry; Grady C. P. L.: Biological wastewater treatment
Course type:	Lectures, exercises, seminars
Assessment method:	Attendance and the final exam
Primary target group:	3rd year students in Environmental Engineering programme, BSc(Undergraduate)

Lecturer:	Małgorzata Cimochowicz-Rybicka, Ph.D. (Eng.), Małgorzata Kryłów, PhD
Contact person:	Małgorzata Cimochowicz-Rybicka, PhD,(Eng.) phone #: +48 12 628 28 65; e-mail: gosia@vistula.wis.pk.edu.pl
Deadline for application:	1st February 2014

COURSE TITLE: **URBAN SURFACE RUNOFF CONTROL**

Institute/Division: Institute of Water Engineering and Management

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The general aim of the module is to get knowledge of: Influence of urbanization on flood hazard, present strategy of management and detention of storm water in order to compensate the loss of natural retention caused by urbanization, relations between water resources protection and flood protection in urban areas, The choice of protection methods based on rainwater retention in connection with flood threat level and kind of town–planning. Students will gain knowledge to gather by the future engineers abilities covering: assessment of usefulness of technical solutions depending on their protective function and techniques of designing some particular solutions on a local scale as well as practical knowledge of various technologies of rainwater storage.

Literature: Osman-Akan, Robert J. Houghtalen / Urban hydrology, hydraulics and stormwater quality; J. Willey & Sons: Hoboken 2003; Other books and papers will be delivered by teaching staff at the beginning of module.

Course type: Lectures, design-type exercises

Assessment method: Design exercises assesment, final test in writing

Primary target group: 3rd year students in Environmental Engineering programme, BSc (Undergraduate)

Lecturer: Andrzej Mączałowski Ph.D. (Eng.)

Contact person: Andrzej Mączałowski Ph.D. (Eng.); phone 0048 12 628 21 88
e-mail: andrzej.maczalowski@iigw.pl

Deadline for application: 1st February 2014

COURSE TITLE: **MUNICIPAL SOLID WASTE MANAGEMENT**

Institute/Division: Institute of Heat Engineering and Air Protection

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The students are expected to understand the new approach to municipal wastes collection and handling towards general principle of sustainable development of cities. Student will gain practical knowledge in application of computer programs to perform analysis of municipal waste management. Specific lectures will focus on following issues: integrated waste management and lifecycle inventory, solid waste generation, pre-sorting and waste collection, central sorting, material recycling, biological treatment, thermal treatment, landfilling.

Literature: White P.R.Franke M., Hindle P. Integrated Solid Waste Management Blackie Academic Professional 1995; Stypka T. ; Municipal Solid Waste Compendium e-book; Other books and papers will be proposedby teaching staff at the beginning of module

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Course type: Lectures, design exercises

Assessment method: Design exercises, final test

Primary target group: 3rd year students in Environmental Engineering programme, B.Sc. (Undergraduate)

Lecturer: Tomasz Stypka,Ph.D. (Eng)

Contact person: Tomasz Stypka PhD. (Eng.); phone 00 48 12 628 2860
e-mail: pisz_mi@wp.pl

Deadline for application: 1st February 2014

COURSE TITLE: **COMPUTER METHODS IN RIVER ENGINEERING**

Institute/Division: Institute of Water Engineering and Management

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The students are expected to acquire knowledge about physical basis of open channel flow related processes, general philosophy of numerical modelling and computer methods used in river engineering. After completion of the course, they posses an ability to recognize and define various engineering problems and use an appropriate method/tool for solving them. Practical result will be an ability to use the professional software package HEC-RAS in wide range of engineering applications as well as familiarization with English terminology related to river engineering. Specific lectures will focus on hydraulic structures design problems: physical basis of computations/applied equations, river bed stability and sediment transport issues, review of numerical method used in 1-D modelling, general philosophy of the modelling systems and processes: model area definition and discretization, boundary/initial conditions, computational parameters. Knowledge about model calibration and verification, result analysis and visualisation, accuracy and stability.

Literature: Reference Manual HEC-RAS, USACE, 2006; User Manual HEC-RAS, USACE, 2006; User Manual MIKE 11, DHI Software, Delft .Other books and papers will be proposed by teaching staff at the beginning of module

Course type: Lectures, seminars, Design exercises

Assessment method: Design exercises assessment

Primary target group: 1th year students in M.SC. Programme in Environmental Engineering

Lecturer: Leszek Lewicki, Ph.D. (Eng.)

Contact person: Leszek Lewicki Ph.D. (Eng.); phone 0048 12 628 21 88
e-mail: leszek.lewicki@iigw.pl

Deadline for application: 1st February 2014

COURSE TITLE: **MECHANICS OF HYDRAULIC STRUCTURES**

Institute/Division: Institute of Geotechnics, Chair of Construction

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The students are expected to gain a knowlegde of theoretical basis and practical skills in applying FEM in design and analysis of hydraulic structures (soil and concrete). Ability to use Z_Soil FEM code for static, filtration and heat transfer problems. Lectures and design exercises will focus on computational models in structural statics, filtration and heat transfer, finite elements for nonlinear and transient problems. Students will be able to solve problems related to elasto-plastic analysis in geotechnics and its finite elements implementation also load capacity and stability analysis in FE. Design exercise will lead to practicise computer simulation of an earth dam behavior under for variable water level condition. Evaluation of technical correctness of analyzed system and on computer simulation of temperature and related mechanical effects in massive concrete structure.

Literature: O.C. Zienkiewicz. Finite element methods; Z_SOIL.PC User manual, Other books and papers will be proposed by teaching staff at the beginning of module

Course type: Lectures, seminars, design exercises

Assessment method: report presentation, final test

Primary target group: 1st year students in M.Sc. Programme in Environmental Engineering

Lecturer: Aleksander Urbański, Professor

Contact person: Aleksander Urbański, Professor, phone 00 48 12 628 2820
e-mail: aurbanski@usk.pk.edu.pl

Deadline for application: 1st February 2014

COURSE TITLE: **SOIL-STRUCTURE INTERACTION**

Institute/Division: Institute of Geotechnics, Chair of Construction

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The aim of this module is to get acquainted with numerical modeling of complex engineering structures interacting with soil by taking into account an effect of nonlinear soil behavior, groundwater flow, consolidation and other rheological phenomena The students are expected to broaden their knowledge concerning: simple elasto-plastic models for soils, calibration of constitutive models based on laboratory and field tests, partially saturated soils, effective stress concept by Bishop, modeling of drained/undrained conditions, finite elements for continuum, beams, anchors, membranes and contact interfaces. Both lecture and practical exercise will focus on computer software for modeling soil-structure interaction problems such as: interaction of structure and soil, contact of two deformable bodies in single and two-phase format, modeling of swelling and its influence on internal force distribution in structures. Basic tool will be the program SOIL.PC v7, so students will work on basic principles of construction of discrete models, macromodeling and its conversion to the finite element model, definition of boundary conditions for partially saturated soils, definition of contact Specific lectures will be on structures endangered by mining activity, static and dynamic cases.

Literature: Lectures prepared by the lecturer available from the web site, Academic version of Z_SOIL.PC downloaded from www.zace.com' User manual for Z_SOIL.PC v7 and video tutorials.

Course type: Lectures, seminars

Assessment method: Preparation of computer model of diaphgram wall, design of the wall reinforcement and preparation of the report , Test exam

Primary target group:	1st year students in M.Sc. Programme in Environmental Engineering
Lecturer:	Andrzej Truty, Professor
Contact person:	Andrzej Truty, Professor, phone #: 0048 12 628 2856 e-mail: atruty@venus.wis.pk.edu.pl
Deadline for application:	1st February 2014

COURSE TITLE: **ALTERNATIVE WATER TREATMENT**

Institute/Division: Institute of Water Supply and Environmental Protection, Chair of Environmental Technologies

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: Main aim of the module is to gain both theoretical and practical knowledge regarding unconventional improvement of potable water quality, process sequences, in-situ treatment as well as problems associated with changes of physic-chemical and microbiological quality during water transportation through the network. Unconventional treatment processes being focused on possible application in developing countries will be a secondary aim of the module. This module is especially recommended for those students, who would like to develop their career based on working for European and or UN organization in developing countries, or for Polish construction enterprises being engaged in these countries.
Students will obtain theoretical background of these subjects., besides they will gain significant practical abilities regarding application of these technologies. Practical application of these knowledge may be applied in two general ranges: first to be applied locally it will be problems associated with a water quality decrease both raw water (in-situ treatment) and in the network (de crease prediction) , prediction of dissemination of quality deterioration; second – to be applied in developing countries - low cost, low chemical technologies (non-chemical coagulation, solar disinfection) Case study – adjustment of alternative technology to specific conditions. Students will develop then present essays focused on one of general subjects: world-wide problems associated with unconventional water treatment and prediction of deterioration of water quality in a network

Literature: NAC „Alternatives for Ground Water Cleanup”*;* R.Morris (ed) Health Related Water Microbiology 2002*;* R.Stuetz(ed.) New research in Water and Wastewater*,* Other books and papers will be proposed by teaching staff at the beginning of module

Course type:	Lectures, seminars
Assessment method:	Presentation of written essay
Primary target group:	1st^{h} year students in M.Sc. Programme in Environmental Engineering
Lecturer:	Stanislaw Rybicki, Dr (Eng)
Contact person:	Dr Stanisław Rybicki, phone #: +48 12 628-25-55; e-mail: smrybicki@interia.pl
Deadline for application:	1st February 2014

COURSE TITLE: **SEWERAGE REAL-TIME MODELING**

Institute/Division: Institute of Water Supply and Environmental Protection, Chair of Water Supply, Sewerage and Environmental Monitoring

Course code: 0053

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: Main aim of the module is to learn principles of non-stationary flow modeling in sewers, on accumulating of pollution in sewerage catchments and they washing out, on average loads of pollution to be potentially realized and partially discharged to the sewerage system, on methods of decreasing the discharge of pollution to storm water sewerage systems. The Storm Water Management Model will be used as an available free domain software suitable for non-stationary flow modeling. Different storm water storage methods will be described and tested in computations.

Students will use then present an application of the SWWM model for a sewerage system of variable rain intensity. Side effect of this module for students of other mother language than English will be broadening professional vocabulary of specialized terms being used in sewerage systems' modeling and design

Literature: SWWM model – reference manual. Use of the SWWM model for practical application – by USEPA, all necessary literature will be accessible via www.

Course type: Lectures, seminars, computer exercises

Assessment method: Design exercises/program use, final test

Primary target group: 1st year students in M.Sc. Programme in Environmental Engineering

Lecturer: Wojciech Dąbrowski, Professor; Robert Płoskonka Ph.D.(Eng.)

Contact person: Wojciech Dąbrowski, Professor, phone #: +48 12 628-25-51;
e-mail: wdabrow@usk.pk.edu.pl

Deadline for application: 1st February 2014

COURSE TITLE: **ENVIRONMENTAL MANAGEMENT**

Institute/Division: Institute of Heat Engineering and Air Protection

Number of contact hours: 30

Course duration: 1 semester (Spring)

ECTS credits: 2

Course description: The main aim of this module is to recognize basic problems related to environmental management and gain knowledge how this problems are being solved. Evaluation of natural environment will also be discussed during lectures. Specific problems discussed during lectures and seminars will cover: Environmental Conflict Management, compartmental approach to EM water, air, waste, energy; Ecosystems Approach to EM (urban-, mountain-, river- environments), Environmental Economics. Project exercise will focus on sustainable development concept and principles and will finalize as joint group project on decision making and the environment – monetary evaluation of the environment

Literature: Turner R,K. Pearce D. Batman I. Environmental Economics an Elementary Introduction Harvester Wheatsheaf 1994; Nath B. Hens L., Compton P., Devuyst D. Environmental Management, Vubpress 1993

Course type: Lectures, design exercises

Assessment method: Design exercises, final test

Primary target group: 1st year students in M.Sc. Programme in Environmental Engineering

Lecturer: Tomasz Stypka,Ph.D. (Eng),

Contact person: Tomasz Stypka, phone 00 48 12 628 2860, e-mail: pisz_mi@wp.pl

Deadline for application: 1st February 2014

COURSE TITLE:	**SUSTAINABLE WASTEWATER TREATMENT**
Institute/Division:	Institute of Water Supply and Environmental Protection, Chair of Environmental Technologies
Course code:	
Number of contact hours:	30
Course duration:	1 semester (Spring)
ECTS credits:	2
Course description:	The module directly addresses the topic of sustainability in wastewater treatment systems. The students will be taught the fundamentals of sustainable designing and operation of wastewater treatment plants. They will be provided with the knowledge regarding multi-media interactions between the wastewater treatment plant and the environment and the method of its evaluation. These will be supplemented with cost-benefit analysis, basics of environmental accounting and risk evaluation methodologies. After the module the students will be able to design sustainable wastewater treatment systems, evaluate them, and provide recommendations for their improvement from sustainability perspective.
Literature:	A list will be presented at the first lecture.
Course type:	Lectures, exercises
Assessment method:	Attendance, exercises, final presentation
Primary target group:	2nd year students in M.Sc. Programme in Environmental Engineering
Lecturer:	Jerzy Mikosz, Ph.D.(Eng.)
Contact person:	Jerzy Mikosz, Ph.D.(Eng.), phone #: (+48 12) 628-2183; e-mail: jmikosz@pk.edu.pl
Deadline for application:	1st February 2014

Faculty of Electrical and Computer Engineering

COURSE TITLE: **MICROPROCESSORS AND MICROCONTROLLERS**

Institute/Division: Chair of Electrotechnics and Electronics / Faculty of Electrical and Computer Engineering

Course code: E3mProc

Erasmus subject code: 11.3

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 6

Course description:

The course begins with an overview of microcontroller-based systems, including applications, architecture, number systems, and languages. The main subjects covered in detail are: microcontroller hardware, CPU registers, internal/external RAM memory, internal/external ROM memory, I/O ports, timers and counters, serial ports, hardware interrupts, clock systems, A/D and D/A converters, connecting the microcontroller to external devices, LCD and LED displays, power devices, measurement of external analog signals and signal processing. Considerable attention is paid to C programming. Students will learn different capabilities of the microcontroller through in class exercises. By the end of this course, the student should be able to write code in C language, respond to input from the user (via buttons or keypad), perform basic binary arithmetic, perform table lookups, display output to the user (via LCD display, LEDs or PC display), control external devices, respond to internal and external interrupts, acquire and analyze analog signals in real-time.

Course type: Lectures (20h), computer laboratory (20h) and project (5h)

Literature:

Joe Pardue, *C Programming for Microcontrollers*, SmileyMicros.com

Steven Barrett, Steven F Barrett, *Embedded System Design with the Atmel AVR Microcontroller*, Morgan & Claypool Publishers, 2009

A.P. Godse, D.A. Godse, *Microprocessor & Microcontroller*, Technical Publications, 2010

Assessment method: Project and laboratory exercises

Prerequisites: digital electronics basics

Primary target group: undergraduate students

Contact person: Wojciech Mysiński, PhD, Eng.,
e-mail: mysinski@pk.edu.pl

COURSE TITLE: **MATLAB PROGRAMMING**

Institute/Division: Chair of Technical Informatics / Faculty of Electrical and Computer Engineering

Course code: E5mlab

Erasmus subject code: 11.3

Number of contact hours: 45

Course duration: 1 semester

ECTS credits: 6

Course description: Introduction to MATLAB development environment, developing scripts and functions. Matrix, table and other data types. Solving algebraic and differential equations, using Symbolic Math Toolbox. Object oriented programming, handle graphics and graphics processing. Parallel computing and other programming tips. Modeling, simulation and control with MATLAB, Simulink, Stateflow and Control System Toolbox. Embedded MATLAB

Matlab Laboratory is prepared by M.Sc D.Grela. Laboratory concerns on practical approach to the topics covered during the lectures. During the course scripts and functions solving problems of varying complexity are created. Such functions solve simple math problems using matrices, tables and other data types. The issues of computer graphics and image processing are also discussed.

Course type: lectures (20h), laboratory (20h), project (5h)

Literature:

1. Tobin A. Driscoll, Learning MATLAB, SIAM 2009
2. MATLAB homepage resources: www.mathworks.com
3. B. Mrozek, Z. Mrozek, MATLAB i Simulink, Poradnik użytkownika (MATLAB and Simulink, 3e: User's Guide – in Polish, for reference only)

Prerequisites: any programming language

Assessment method: Laboratory exercises and project.

Lecturers: dr Zbigniew MROZEK PhD,

Contact person: dr Zbigniew MROZEK, PhD,
Zbigniew.mrozek@pk.edu.pl
http://www.cyf-kr.edu.pl/~pemrozek/

Remarks: MATLAB, Simulink, Control System Toolbox and Symbolic Math Toolbox are available in computer laboratory. Other MATLAB extensions will be used during lecture

COURSE TITLE: **SOFTWARE ENGINEERIG**

Institute/Division: Faculty of Electrical and Computer Engineering - E5

Course code: E5softEn

Erasmus subject code: 11.3

Number of contact hours: 45 (20h lectures, 20h laboratory, 5h project)

Course duration: 1 semester

ETCS credits: 6

Course description: Software engineering ethics, Life cycle, Software process models, The Rational Unified Process, Extreme programming, Agile project management, Requirements engineering, Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements elicitation and analysis, Requirements validation, System modeling, Interaction models, Structural models, Behavioral models, Model-driven engineering, Architectural design decisions, Software Quality, Software Testing, Software Maintenance and Control, Computer Aided Software Engineering,

Software Engineering Laboratory, is prepared by MSc D, Grela

Laboratory concerns on reusable object-oriented software, so called design patterns. The idea is that when designing a new class hierarchy, though implementation details may differ, you often find yourself using the same kinds of solutions over and over again. Rather than approaching each design task out of context as an individual, isolated problem, the strategy is to study the task and identify the underlying design pattern most likely to be applicable, and follow the class structure outlined by that pattern. Software Engineering laboratory helps object-oriented programmers to take full advantage of the extra power offered by Java language.

Most important design patterns discussed during this course are: Composite, Chain Of Responsibility, Decorator, Flyweight, Bridge, Prototype and Builder.

Course type: Lectures, computer laboratory and project

Literature

1. Ian Sommerville, Software Engineering, Pearson 2010
2. IEEE Recommended Practice for Software Requirements Specifications, IEEE Computer Society, IEEE Std 830-1998
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software

Assessment method Project and laboratory exercises

Contact person: dr inz. Zbigniew MROZEK, PhD, Eng.
zbigniew.mrozek@pk.edu.pl

COURSE TITLE: **Object Oriented Programming and UML**

Institute/Division: Faculty of Electrical and Computer Engineering, - E5

Course code E5oopUML

Erasmus subject code 11.3

Number of contact hours: 45 (20h lectures, 20h laboratory, 5h project)

Course duration: 1 semester (fall)

ETCS credits: 6

Course description: OO Principles, CASE Tools and environments
RUP and Unified Modeling Language, UML 1.4 vs actual version
Development Approaches, Requirements Elicitation
Actors and Use Cases, Use Case Modeling
Objects and Classes, Links, Associations and Multiplicity
Generalization and Inheritance,
Advanced Relationships and Aggregation
Introduction to Interaction Modeling
Sequence and Communication Diagrams,
State Machine and Activity Diagrams
Behavior and Protocol State Machines
Advanced State Diagrams
Packages and other UML diagrams
Designing the Details

The course covers the latest, key developments in Object Oriented Programming

Course type: Lectures, computer laboratory and project

Literature

4. Bruegge, Dutoit Object-Oriented Software Engineering Using UML, Patterns, and Java (3rd Edition), Pearson, 2010
5. Bennett, McRobb and Farmer, Object Oriented Systems Analysis and Design using UML, 3/e, McGraw-Hill 2006
6. Martin Fowler, UML Distilled: A Brief Guide to the Standard Object Modeling Language (3rd Edition), 2003
7. IEEE Recommended Practice for Software Requirements Specifications, IEEE Computer Society, IEEE Std 830-1998

Assessment method Project and laboratory exercises

Contact person: dr inz. Zbigniew MROZEK, PhD, Eng.
email zbigniew.mrozek@pk.edu.pl

COURSE TITLE: **JAVA PROGRAMMING**

Institute/Division: Chair of Technical Informatics / Faculty of Electrical and Computer Engineering

Course code: E5-java

Erasmus subject code: 11.3

Number of contact hours: 45

Course duration: 1 semester (Fall)

ECTS credits:

Course description: Introduction to object orientem programming. Expressions. Controlling execution. Initialization and Cleanup. Access Control.
Inheritance. Polymorphism. Interfaces. Error handling. Input/Output streams. Generics. Containers. Strings. Arrays.Enumerated types.
Concurrency. Network. Swing: GUI. Swing: handling events.

Course type: lectures (20h), laboratory (20h), project (5h)

Literature: Bruce Eckel, Thinking in Java, 4th Edition;
The Java Tutorial. A practical guide for programmers, http://java.sun.com

Prerequisites: C programming

Assessment method: Project and implementation of a simple Java programme. Laboratory exercises.

Lecturers: Stanisław Deniziak PhD, DSc and Damian Grela, MSc

Contact person: Stanisław Deniziak, e-mail: S.Deniziak@computer.org

COURSE TITLE: **COMPUTER ARCHITECTURE AND SYSTEM DESIGN**

Institute/Division: Chair of Technical Informatics / Faculty of Electrical and Computer Engineering

Course code : E5-compA

Erasmus subject code : 11.3

Number of contact hours: 45

Course duration: 1 semester (Spring)

ECTS credits: 6

Course description: Lectures:
Introduction to Computer Organization. Top Level View of Computer. Memory Organization. Input/Output Organization.
Instruction Set. RTL-level Design. Instruction Level Parallelism: Pipelined and Superscalar Processors. Parallel Processing: Multiprocessor
Architectures. Embedded Systems. Hardware/Software Co-design.
Laboratory exercises: Introduction to the Altera Quartus II design software and the DE2 FPGA Evaluation Board. Designing of simple digital systems using VHDL language - multiplexers, controlling switches and LEDs. Designing of combinational circuits – arithmetic circuits, decoders for 7-segment displays. IP-based designing - Library of Parameterized Modules (LPM). Designing of sequentialcircuits – registers, counters, clocks. Finite state machines (FSM) and designing on the register transfer level (RTL). Introduction to the Altera SOPC Builder and NIOS II processor. A simple computer system. Program-Controlled Input/Output. Interrupts. Bus communication.

Course type: lectures (20h), laboratory (20h), project (5h)

Literature:

William Stallings, Computer Organization and Architecture, Prentice Hall, 2009
David A. Patterson and John L. Hennessy Computer Organization and Design, Fourth Edition, 4th Edition, The Hardware/Software Interface, Morgan Kaufmann, 2008
Wayne Wolf, “High-Performance Embedded Computing”, Elsevier Inc., 2007.
Quartus II Development Software v9.1 Handbook, Altera Corp., http://www.altera.com/literature/hb/qts/quartusii_handbook.pdf

Nios II Software Developer's Handbook, Altera Corp., http://www.altera.com/literature/hb/nios2/n2sw_nii5v2.pdf

Prerequisites: Digital logic

Assessment method: Project of a simple computer system. Laboratory exercises

Lecturers: Stanisław Deniziak PhD, DSc and Radosław Czarnecki, PhD

Contact person: Stanisław Deniziak, e-mail: S.Deniziak@computer.org

COURSE TITLE: **POWER ELECTRONICS FOR POWER QUALITY IMPROVEMENT**

Institute / Division: Chair of Circuit Theory and Electronics / Faculty of Electrical and Computer Engineering

Number of contact hours: 60

Duration: 1 semester

ECTS credits: 5

Programme description: This course comprises lectures and computer simulations. It covers basic aspects of electric power quality improvement with the use of power electronic converters. Modern non-active powers compensation techniques are discussed. All subjects are clarified and made familiar using exercises and computer simulations. Subjects of the course are listed below:

- Electric power definitions
- Evolution of electric power theory
- Components of load current and power
- Detection of non-active load current and power components
- Principles of active compensation
- Introduction to power electronic converters used for power quality improvement
- Single- and three-phase shunt active power filter
- PFC rectifier

Course type: lectures (30h), exercises (18h), computer simulations (12h)

Contact person: Andrzej Szromba, PhD, Eng.
e-mail: aszromba@pk.edu.pl

COURSE TITLE: **MODELING OF DYNAMIC SYSTEMS**

Institute/Division: Department of Automatic Control and Information Technology (E-7)

Number of contact hours: 35

Course duration: 1 semester (Fall)

ECTS credits: 5

Course description: Dynamic systems and their models. Ordinary differential equations. Solutions of differential equations; existence and uniqueness. Numerical methods for differential equations. Graphical interpretation; isoclines. Dynamic systems with discrete time; difference equations. Linear differential equations; variation of parameters method. Linear differential equations with constant parameters (linear-stationary). Introduction to Laplace transform. Transmittance. Fundamental dynamic elements. Introduction to nonlinear differential equations. Introduction to partial differential equations.

Optional topics: role of information technology.

Literature: Selected passages from subject literature

Course type: Lectures (20 h), computer laboratory (15 h)

Assessment method: Attendance and exam

Prerequisites: Basics of mathematics and programming

Lecturer: Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.

Contact person: Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE:	**CONTROL ENGINEERING**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	35
Course duration:	1 semester (Fall)
ECTS credits:	5
Course description:	History and subject of control engineering. Model of object. Features of model: linearity, stationarity, continuous/discrete time. Description of object dynamics: state space, transmittance. Fundamental dynamic elements. Classical approach: on / off and PID controllers, decoupling. Introduction to optimal control. Optional topics: PLC controllers.
Literature:	Selected passages from subject literature
Course type:	Lectures (20 h), laboratory / computer laboratory (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics and programming
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE:	**AUTOMATIC CONTROL**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Spring)
ECTS credits:	6
Course description:	Subject of automatic control. Review of basics: model, state space, transmittance, on / off and PID controllers. Controllability, stability, observability; definitions, interpretations, criterions. Observers and filters. Pontryagin's maximum principle, Bellman dynamic programming. Minimum-time and quadratic optimal control. Robust and adaptive control. Fault detection. Hierarchical systems. Optional topics: computer control systems.
Literature:	Selected passages from subject literature
Course type:	Lectures (30 h), computer laboratory / project (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics, programming, control engineering and modeling of dynamic systems
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE:	**PROBABILITY IN ENGINEERING APPLICATIONS**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Fall)
ECTS credits:	6
Course description:	Subject of probability methods; probability calculus, stochastic processes, mathematical statistics. Applicational possibilities in engineering and econometrics. Other types of indeterminacy; imprecision – fuzzy logic. Probability space, random variable, distribution of random variable. Relationship to classical probability (combinatorial). Typical distributions. Pseudorandom numbers generators. Characterization of distribution: density, distribution function and parametric characteristics (moments, quantiles). Stochastic processes; white noise. Introduction to point estimation; examples of classical estimators. Introduction to statistical testing hypothesis. Introduction to decision making. Exemplary applications for parameter identification, fault detection and management tasks. Optional topics: applications of information technology.
Literature:	Selected passages from subject literature
Course type:	Lectures (30 h), computer laboratory / project (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics and programming
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE:	**DATA ANALYSIS AND EXPLORATION**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Spring)
ECTS credits:	6
Course description:	Knowledge discovery in data. Subject of data analysis and exploration. Supervised and unsupervised learning. Review of basics of probability. Nonparametric estimation; kernel estimators. Data visualization. Preliminary handling of data. Handling missing data. Identification of atypical elements (outliers). Clustering. Classification. Dimensionality reduction. Examples of applications in engineering and econometrics. Optional topics: prediction (forecasting).
Literature:	Selected passages from subject literature
Course type:	Lectures (25 h), computer laboratory / project (20 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics (in particular probability) and programming
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math. Szymon Łukasik, M.Sc.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl Szymon Łukasik, phone: +48 12 628-26-92, e-mail: szymonl@pk.edu.pl

COURSE TITLE:	**COMPUTER NETWORKS**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Fall)
ECTS credits:	6
Course description:	The course comprises lectures, laboratory exercises and individual project. It is designed to provide the student with understanding of modern networking technologies and basics of network administration. The topics of the lectures include: Introduction to communication networks – requirements and basic concepts. Computer networks architectures. OSI and TCP/IP models. Fundamentals of data transmission: media, encoding, error detection and reliable communication. Local area networks. Ethernet and token-based protocols. Networks interconnection. IP protocols – IPv4 and IPv6. Fundamental routing algorithms – distance vector and link state methods. Interdomain routing. Address translation and error reporting protocols – ARP, RARP and ICMP. Transport layer protocols – UDP and TCP. Host configuration. Domain name service – servers and name resolution. Electronic mail, world-wide web and network management protocols. Fundamentals of wireless networking (802.11 standards). Selected aspects of network security: threats and essential tools. Secure protocols and short introduction to cryptography. Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of computer networks protocols and fundamental network administration tasks.
Literature:	Selected reviews from scientific literature.
Course type:	Lectures (20h), laboratory (20h) and project (5h)
Assessment method:	Project, laboratory exercises and written exam.
Target group:	Students in Computer Science, Control and Electrical Eng.
Lecturer:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl Szymon Łukasik, MSc, Eng., e-mail: szymonl@pk.edu.pl

Contact person: Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Szymon Łukasik, MSc, Eng., e-mail: szymonl@pk.edu.pl

COURSE TITLE:	**NEURAL NETWORKS**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Fall)
ECTS credits:	6
Course description:	During the course the student learns the basics structures of neural networks. The student should acquire knowledge, skills and competence in the field of neural networks. The topics of the lectures include: Basic concepts of artificial intelligence, general description of the neural networks. Comparison classical algorithms with neural methods. Analysis of artificial neural network by analogy to human brain. Structure of single artificial neuron. Architectures of selected neural networks structures. Procedures of neural network learning and training. Artificial neural network with feedback. Complexity and applications of neural algorithms. Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of neural networks procedures.
Literature:	Selected reviews from scientific literature.
Course type:	Lectures (20h), computer lab. (15h) and project (10h)
Assessment method:	Project, laboratory exercises and written exam.
Target group:	Students in Computer Science, Control and Electrical Eng.
Lecturer:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Contact person:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl

COURSE TITLE:	**NATURAL COMPUTING**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Spring)
ECTS credits:	6
Course description:	The course comprises lectures, laboratory exercises and individual project. During the course the student learns the procedures of natural computing. The student should acquire knowledge, skills and competence in the field of natural computing, enabling him to themselves solving engineering problems. The topics of the lectures include: Introduction to techniques those that take inspiration from nature for the development of novel problem-solving techniques: genetic algorithms, evolutionary strategies, evolutionary programming, swarm intelligence, artificial immune systems, artificial life, DNA computing, and quantum computing. Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of nature-inspired metaheuristic algorithms
Literature:	Selected reviews from scientific literature.
Course type:	Lectures (20h), computer lab. (15h) and project (10h)
Assessment method:	Project, laboratory exercises and written exam.
Target group:	Students in Computer Science, Control and Electrical Eng.
Lecturer:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Contact person:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl

COURSE TITLE: **MODELING OF DYNAMIC SYSTEMS**

Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	35
Course duration:	1 semester (Fall)
ECTS credits:	5
Course description:	Dynamic systems and their models. Ordinary differential equations. Solutions of differential equations; existence and uniqueness. Numerical methods for differential equations. Graphical interpretation; isoclines. Dynamic systems with discrete time; difference equations. Linear differential equations; variation of parameters method. Linear differential equations with constant parameters (linear-stationary). Introduction to Laplace transform. Transmittance. Fundamental dynamic elements. Introduction to nonlinear differential equations. Introduction to partial differential equations. Optional topics: role of information technology.
Literature:	Selected passages from subject literature
Course type:	Lectures (20 h), computer laboratory (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics and programming
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE: **CONTROL ENGINEERING**

Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	35
Course duration:	1 semester (Fall)
ECTS credits:	5
Course description:	History and subject of control engineering. Model of object. Features of model: linearity, stationarity, continuous/discrete time. Description of object dynamics: state space, transmittance. Fundamental dynamic elements. Classical approach: on / off and PID controllers, decoupling. Introduction to optimal control. Optional topics: PLC controllers.
Literature:	Selected passages from subject literature
Course type:	Lectures (20 h), laboratory / computer laboratory (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics and programming
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE: **AUTOMATIC CONTROL**

Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Spring)
ECTS credits:	6
Course description:	Subject of automatic control. Review of basics: model, state space, transmittance, on / off and PID controllers. Controllability, stability, observability; definitions, interpretations, criterions. Observers and filters. Pontryagin's maximum principle, Bellman dynamic programming. Minimum-time and quadratic optimal control. Robust and adaptive control. Fault detection. Hierarchical systems. Optional topics: computer control systems.
Literature:	Selected passages from subject literature
Course type:	Lectures (30 h), computer laboratory / project (15 h)
Assessment method:	Attendance and exam
Prerequisites:	Basics of mathematics, programming, control engineering and modeling of dynamic systems
Lecturer:	Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Contact person:	Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE: **PROBABILITY IN ENGINEERING APPLICATIONS**

Institute/Division: Department of Automatic Control and Information Technology (E-7)

Number of contact hours: 45

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: Subject of probability methods; probability calculus, stochastic processes, mathematical statistics. Applicational possibilities in engineering and econometrics. Other types of indeterminacy; imprecision – fuzzy logic. Probability space, random variable, distribution of random variable. Relationship to classical probability (combinatorial). Typical distributions. Pseudorandom numbers generators. Characterization of distribution: density, distribution function and parametric characteristics (moments, quantiles). Stochastic processes; white noise. Introduction to point estimation; examples of classical estimators. Introduction to statistical testing hypothesis. Introduction to decision making. Exemplary applications for parameter identification, fault detection and management tasks.

Optional topics: applications of information technology.

Literature: Selected passages from subject literature

Course type: Lectures (30 h), computer laboratory / project (15 h)

Assessment method: Attendance and exam

Prerequisites: Basics of mathematics and programming

Lecturer: Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.

Contact person: Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl

COURSE TITLE: **DATA ANALYSIS AND EXPLORATION**

Institute/Division: Department of Automatic Control and Information Technology (E-7)

Number of contact hours: 45

Course duration: 1 semester (Spring)

ECTS credits: 6

Course description: Knowledge discovery in data. Subject of data analysis and exploration. Supervised and unsupervised learning. Review of basics of probability. Nonparametric estimation; kernel estimators. Data visualization. Preliminary handling of data. Handling missing data. Identification of atypical elements (outliers). Clustering. Classification. Dimensionality reduction. Examples of applications in engineering and econometrics.

Optional topics: prediction (forecasting).

Literature: Selected passages from subject literature

Course type: Lectures (25 h), computer laboratory / project (20 h)

Assessment method: Attendance and exam

Prerequisites: Basics of mathematics (in particular probability) and programming

Lecturer: Piotr Kulczycki, Prof., D.Sc., Ph.D., M.Sc.E.E., M.Sc.Math.
Szymon Łukasik, M.Sc.

Contact person: Piotr Kulczycki, phone: +48 12 628-29-56, +48 12 628-26-85, e-mail: kulczycki@pk.edu.pl
Szymon Łukasik, phone: +48 12 628-26-92, e-mail: szymonl@pk.edu.pl

COURSE TITLE: **COMPUTER NETWORKS**

Institute/Division: Department of Automatic Control and Information Technology (E-7)

Number of contact hours: 45

Course duration: 1 semester (Fall)

ECTS credits: 6

Course description: The course comprises lectures, laboratory exercises and individual project. It is designed to provide the student with understanding of modern networking technologies and basics of network administration.
The topics of the lectures include:
Introduction to communication networks – requirements and basic concepts. Computer networks architectures. OSI and TCP/IP models. Fundamentals of data transmission: media, encoding, error detection and reliable communication. Local area networks. Ethernet and token-based protocols. Networks interconnection. IP protocols – IPv4 and IPv6. Fundamental routing algorithms – distance vector and link state methods. Interdomain routing. Address translation and error reporting protocols – ARP, RARP and ICMP. Transport layer protocols – UDP and TCP. Host configuration. Domain name service – servers and name resolution. Electronic mail, world-wide web and network management protocols. Fundamentals of wireless networking (802.11 standards). Selected aspects of network security: threats and essential tools. Secure protocols and short introduction to cryptography.
Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of computer networks protocols and fundamental network administration tasks.

Literature: Selected reviews from scientific literature.

Course type: Lectures (20h), laboratory (20h) and project (5h)

Assessment method: Project, laboratory exercises and written exam.

Target group: Students in Computer Science, Control and Electrical Eng.

Lecturer: Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Szymon Łukasik, MSc, Eng., e-mail: szymonl@pk.edu.pl

Contact person:

Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Szymon Łukasik, MSc, Eng., e-mail: szymonl@pk.edu.pl

COURSE TITLE:	**NEURAL NETWORKS**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Fall)
ECTS credits:	6
Course description:	During the course the student learns the basics structures of neural networks. The student should acquire knowledge, skills and competence in the field of neural networks. The topics of the lectures include: Basic concepts of artificial intelligence, general description of the neural networks. Comparison classical algorithms with neural methods. Analysis of artificial neural network by analogy to human brain. Structure of single artificial neuron. Architectures of selected neural networks structures. Procedures of neural network learning and training. Artificial neural network with feedback. Complexity and applications of neural algorithms. Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of neural networks procedures.
Literature:	Selected reviews from scientific literature.
Course type:	Lectures (20h), computer lab. (15h) and project (10h)
Assessment method:	Project, laboratory exercises and written exam.
Target group:	Students in Computer Science, Control and Electrical Eng.
Lecturer:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Contact person:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl

COURSE TITLE:	**NATURAL COMPUTING**
Institute/Division:	Department of Automatic Control and Information Technology (E-7)
Number of contact hours:	45
Course duration:	1 semester (Spring)
ECTS credits:	6
Course description:	The course comprises lectures, laboratory exercises and individual project. During the course the student learns the procedures of natural computing. The student should acquire knowledge, skills and competence in the field of natural computing, enabling him to themselves solving engineering problems. The topics of the lectures include: Introduction to techniques those that take inspiration from nature for the development of novel problem-solving techniques: genetic algorithms, evolutionary strategies, evolutionary programming, swarm intelligence, artificial immune systems, artificial life, DNA computing, and quantum computing. Laboratory exercises and individual project are aimed to supply additional practical knowledge in the area of nature-inspired metaheuristic algorithms
Literature:	Selected reviews from scientific literature.
Course type:	Lectures (20h), computer lab. (15h) and project (10h)
Assessment method:	Project, laboratory exercises and written exam.
Target group:	Students in Computer Science, Control and Electrical Eng.
Lecturer:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl
Contact person:	Piotr A. Kowalski, PhD, Eng., e-mail: pkowal@pk.edu.pl

COURSE TITLE: POLISH LANGUAGE COURSE FOR FOREIGNERS
Duration: as arranged with candidates
Course description: This course is for foreigners interested in learning the Polish language
Web page: http://www.educentre.info
Fees: depend on course duration and number of candidates
Contact person: Tomasz Jeleński, PhD, Arch.
Phone#: +48 12 648 49 50 or +48 12 649 22 77;
e-mail: tjelenski@pk.edu.pl
Application procedures
& deadlines: ongoing application, application form to be sent to
mck@pk.edu.pl
Remarks: Courses at the following levels are available: A1, A2, B1, B2, C1, C2 and the Polish language for MSc and PhD candidates 376

COURSE TITLE: PREPARATORY COURSE FOR INTERNATIONAL STUDENTS WISHING TO EARN THEIR BSC OR MSC DEGREE AT POLISH UNIVERSITIES I
Duration: 2 semesters (30 weeks), from 1st October to 30th June
ECTS credits: 44-80 (depending on a type of preparatory course)
Course description: This course is for international students ***interested in studies in Polish*** at Polish universities. The course includes the Polish language, free hand drawing, mathematics, physics and other courses
Web page: http://www.educentre.info
Eligibility/Admission: Secondary school diploma (for bachelor's preparatory course) or Bachelor's degree (for master's preparatory course)
Fees: 3 200 Euro
Contact person: Tomasz Jeleński, PhD, Arch.
Phone#: +48 12 648 49 50 or +48 12 649 22 77;
e-mail: tjelenski@pk.edu.pl
Application procedures
& deadlines: application to be sent to mck@pk.edu.pl by 15th September each year
Types of preparatory
courses offered: Preparatory course for architecture and fine arts studies
Preparatory course for technical studies

Preparatory course for economical studies
Preparatory course for administrative and business studies
Remarks: The International Educational Centre is one of the few schools of this type in Poland which has the right to recommend its alumni to university studies without the necessity to take entrance exams (except medical studies). 377

COURSE TITLE: PREPARATORY COURSE FOR INTERNATIONAL STUDENTS WISHING TO EARN THEIR BSC OR MSC DEGREE AT POLISH UNIVERSITIES II
Duration: 2 semesters (30 weeks), from 1st October to 30th June
ECTS credits: 44-80 (depending on a type of preparatory course)
Course description: This course is for international students ***interested in studies in English*** at Polish universities. The course includes the English language, free hand drawing, mathematics, physics and other courses
Web page: http://www.educentre.info
Eligibility/Admission: Secondary school diploma (for bachelor's preparatory course) or Bachelor's degree (for master's preparatory course)
Fees: 4 200 Euro
Contact person: Tomasz Jeleński, PhD, Arch.
Phone#: +48 12 648 49 50 or +48 12 649 22 77;
e-mail: tjelenski@pk.edu.pl
Application procedures & deadlines: application to be sent to mck@pk.edu.pl by 15th September each year
Types of preparatory courses offered: Preparatory course for architecture and fine arts studies
Preparatory course for technical studies
Preparatory course for economical studies
Preparatory course for administrative and business studies
Remarks: The International Educational Centre is one of the few schools of this type in Poland which has the right to recommend its alumni to university studies without the necessity to take entrance exams (except medical studies). 378

COURSE TITLE: POLISH LANGUAGE COURSE FOR EXCHANGE STUDENTS OF ERASMUS PROGRAMME (30 HRS or 60 HRS)
Duration: 1 semester (15 weeks)

ECTS credits: 5
Course description: The programme is designed as introductory course of the Polish language for foreigners
Web page: http://www.educentre.info
Contact person: Tomasz Jeleński, PhD, Arch.
Phone#: +48 12 648 49 50 or +48 12 649 22 77;
e-mail: tjelenski@pk.edu.pl
Application procedures
& deadlines: applications to be sent to the Erasmus Office at the Cracow University of Technology at erasmus@pk.edu.pl by October 31 or May 30
Remarks: Level A0 – Survival Polish