SUMMER SCHOOL 2020

9-31 July 2020

Wrocław University
of Science and Technology

About 3E+

Our Programme offers interactive small-scale courses (max. 10 students), which are designed to provide an intensive, in-depth look at your topic of study. As 3E+ is open to applicants from all over the world, you will engage in discussions with a unique group of peers!

Apart from lessons, you will get to enjoy our fun and exciting Social Programme! We arrange a variety of social events to help you get to know your colleagues and Poland better while having fun!

Why 3E+ Summer School?

+ 60 hours of specialized courses in a friendly atmosphere
+ laboratory activities
+ 4 ECTS points
+ trips, events, social activities
+ Polish language and culture course
+ 8th edition
+ participants from all over the world
+ and much more

Why Wrocław?

+ one of the major academic centers in Poland
+ modern, open and dynamic city with rich history and culture
+ in the heart of Europe and in southwestern Poland, Wrocław is easily accessible from many other major cities
+ approx. 1 million residents in the greater Wrocław area.

Why WUST?

+ one of the best technical universities in Poland
+ over 26 000 students
+ over 2000 academic staff
+ 33 distinguished educational programmes, including courses taught in English and MBA programmes
+ Campus located in the city center

When? 9-31 July 2020

+ application deadline 08.05.2020

How much does it cost?

1100 euro
Early bird **990 euro** (application before 03.04.2020)
10% discount for students from partner institution

What is included?

+ tuition
+ accommodation
+ lunches on weekdays
+ get together party
+ trips, events and social activities
+ welcome pack

...and not included?

+ airfare and visa's cost (if required)
+ insurance
+ living expenses

3e+ Offer

CHOOSE ONE OF OUR COURSES AND EARN 4 ECTS POINTS:

- Auditoria Design – Architectural Acoustics
- Quality control and technical evaluation of building and civil engineering structures
- Green fuels and environment
- Optical Fibre Communications
- Optimization and processing algorithms in practical applications
- Internet of Things – from hardware sensors to data analysis and mobile application
- SMS in PQ ⇨ Smart Measuring Systems and Power Quality
- Programmable Logic Controllers PLC
- Thermal comfort and renewable energy for low energy buildings
- Design Thinking for Innovation in 21st Century
- Renewable energy sources in household and power sector – from idea to technology
- Solar-assisted HVAC systems
- Build your own scooter with an interdisciplinary team of WUST experts
- MEMS and mechatronic systems with LabVIEW
- It's a MEMS, MEMS world …
- Introduction to Data Science with Python
- Anomalous diffusion models with application to biological data
- Graphs and their Applications

Offer

Auditoria Design – Architectural Acoustics
FACULTY OF ARCHITECTURE

Gain theoretical knowledge and practical skills in shaping architecture for its' optimal acoustical performance. The combination of studio design workshop, with broad knowledge on sound and architecture – with their mutual influence – passed during lectures and seminars, allow participants to gain usable and thorough understanding of acoustical field properties in room planning. Comprehensive review connected with projects of diversified auditoria halls, meant for: speech, music, art performance or religious celebrations – like concert halls, theatres, opera houses, temples, lecture theatres – are aiming at enriching and expanding knowledge on architectural acoustics of students majoring in architecture.

Quality control and technical evaluation of building and civil engineering structures
FACULTY OF CIVIL ENGINEERING

Gain knowledge concerning procedures and advanced testing methods which can be applied for quality control and technical evaluation of different building and civil engineering structures. The course will introduce you to basic principles and practical applications of several modern testing systems. Particular attention is paid to the NDT methods (Non Destructive Testing) that can be applied for „in-situ" examination. One of the most important aspects of proposed course is to offer you a possibility for practical training in using modern testing systems in laboratory and „in-situ" conditions.

Green fuels and environment
FACULTY OF CHEMISTRY

Gain knowledge about fuel properties, with particular emphasis on biofuels, and the impact of their use on environmental protection. Learn about fuel economy - types of fuels, standards, the ability to manufacture and store fuels, etc.

Understand the characteristics of liquid and gaseous fuels in relation to the composition of fumes and their impact on the natural environment. Get an insight into technologies for the production of fuels, especially alternative fuels and biofuels along with the use of new separation methods for the purification of waste streams, and the recovery of valuable compounds. Explore issues related to the use of supercapacitors and lithium ion batteries that affect the development of motoring.

Optical Fibre Communications
FACULTY OF ELECTRONICS

Optical fibres are great, aren't they? Whole fast communication is based on them. But how does it work? Do you know how to build a laser or how to measure basic parameters in fibre networks? After completing these course you will have knowledge about this: laser devices, optical network elements, optical reflectometers, optical fibre splicers, fibre amplifiers, and how to design a fibre optic network. But you will gain so much more than theoretical knowledge! A lot of people prefer to touch everything and do things by themselves... so the largest part of this course will be based on the construction and testing of real network elements. After completing the course you will be able to use laser devices in a safe way, measure optical elements parameters, use optical reflectometers, perform optical fibre splicing, fibre

connectorization and polishing, measure and construct fibre amplifiers, measure and construct fibre lasers and design a fibre optic network.

Optimization and processing algorithms in practical applications
FACULTY OF ELECTRONICS

Still increasing user's requirements trigger the fast development of communication networks. Therefore, new technologies emerge, however, they bring challenging optimization problems. Another important branch of computer science is the image processing together with learning systems. The capabilities of modern computing devices allow for real-time image processing, finding numerous applications in industry, entertainment and everyday life.

The course focuses on the efficient approaches of modeling and optimization of network problems, as well as on the main issues related to the design and implementation of image processing and learning systems. Students will work with the case study related to relevant and up to date problems for which the solution algorithms are highly required.

Internet of Things – from hardware sensors to data analysis and mobile application
FACULTY OF ELECTRONICS

The course will guide students through the whole development process of simple IoT application. Starting from Arduino-based environment sensors through wireless communication to the cloud using LoRa low-power radios, to design of data processing and analysis algorithms, and the design of a mobile application. During the course students will use different technologies (including REST, MQTT, time series forecasting and multi
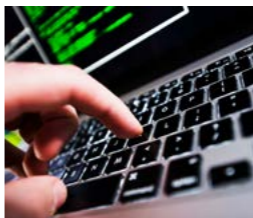
layer perceptrons) and programming languages (C for Arduino, Python for data analysis and server application, and Java for Android application). Students will learn basic concepts of IoT systems, techniques of data processing and analysis, and will get a grasp of constructing a real life IoT system.

SMS in PQ ⇨ Smart Measuring Systems and Power Quality

FACULTY OF ELECTRICAL ENGINEERING

The course consists of two parts and is intended for students of every level. The main aim of the first part is to present graphical programming environment LabView in use to control measurement equipment. In this part students can start from "level zero" or start to program measurement equipment like power sources, generators, oscilloscopes, digital multimeters or DAQ boards. The result of the first part of the course is creating reports based on obtained data. The second part of this course is about basic problems and practical aspects of power quality assessment in power systems. After an introduction of general knowledge, the following problems will be presented:

✚ classes of power quality problems, ✚ PQ standards, ✚ PQ smart measurement systems, ✚ algorithms for power quality assessment.

Programmable Logic Controllers PLC

FACULTY OF ELECTRICAL ENGINEERING

The main aim of the course is to show and explain Programmable Logic Controllers industrial cases. During the course, future engineers will prepare PLC configuration, design and develop solutions for some common practical problems, design and program the distributed system using programmable

controllers. The course is focused around explanation of the practical problems encountered in Programmable Logic Controllers (PLC) on the basis of the Siemens family SIMATIC S7-1200 and S7-1500. The following topics are covered:

+ basic aspects of PLC application in industry, + PLC operation of basic peripherals, + graphical languages (LADDER or FBD), + basic programming tools, + arithmetic and logic operations, + timers and counters, + latches and flip-flops.

Thermal comfort and renewable energy for low energy buildings
FACULTY OF ENVIRONMENTAL ENGINEERING

Learn to understand the holistic approach to the design of low energy demand buildings with special emphasis on the utilisation of renewable energy in building, installations, application of heat recovery systems and maintaining thermal comfort of users. The course focuses on the subject of thermal comfort, heat production (to supply heating and domestic hot water systems), with additional aspect of passive cooling and heat recovery through ventilation for low energy buildings. Get an insight into solutions based on sustainable design including, among others, solar thermal collectors, air-to-water heat pumps, energy recovery heat exchangers in air handling units and ground heat exchangers. You will participate mostly in active forms like laboratory, calculus and simple project.

Design Thinking for Innovation in 21st Century
FACULTY OF COMPUTER SCIENCE AND MANAGEMENT

21st century is driven by Innovation. It has changed the way we live, do business, travel, communicate and everything else that one might think

of. Whether you want to be an engineer, a manager, an entrepreneur, a teacher, a researcher or a politician; expectations from you would be to do the most with the least resources. This is where 'Design Thinking' comes in! It's a tool that will be helpful to you at any level, any role and in any organization you work in or run. Design Thinking also equips you to become an innovative thinker and to unearth creative opportunities that are around you. This module at the 3E+ Summer School, is designed to familiarize you with the concept of design thinking help, you understand each stage of the process and apply all of it for a practically feasible project. This course can be attended by individuals from any level & field. The only criteria for acceptance are: having passion, dedication & will, to be Innovative & Creative.

Renewable energy sources in household and power sector – from idea to technology

FACULTY OF MECHANICAL AND POWER ENGINEERING

The course covers production and detailed characterization of different types of renewable fuels, including solid biofuels, biogas and hydrogen production, analytical techniques and numerical simulations. Technologies on different levels of technical maturity will be shown and discussed, so participants will be able to understand the basic principles and the issues behind the development of new technologies. The course gives an unique opportunity to have a glimpse of the challenging process of design and commercialization into cutting edge technologies in the energy sector. This course is an opportunity to develop practical skills and inspire new generation of future engineers and visionaries.

³e+Offer

Solar-assisted HVAC systems
FACULTY OF MECHANICAL AND POWER ENGINEERING

The course is focused on the experimental research of solar–assisted HVAC systems. We will start introducing fundamentals of solar energy, being the most plentiful energy source on earth. Different types of solar collectors and fields of their applications will be discussed. Furthermore, an bioclimatic building's solar-assisted HVAC system will be presented as an example

of how we can decrease the energy use for heating and cooling. Students will have the opportunity to experimentally examine the energy efficiency of solar collectors as well as analyze the operation sequence of the real examples of solar-assisted HVAC systems. The individual components of the solar-assisted HVAC system (including heat and cold storage systems) will be discussed. The hands-on laboratory sessions covers, among others, performing measurements on the solar elevation and azimuth angles, determination of geographic southwest as well the measurements of global and diffuse solar radiation. The students will gain knowledge about the basic elements of solar-assisted HVAC systems and determining the efficiency of it. They will become familiar with the operation control strategies applied into solar-assisted HVAC systems and the use of different sensors applied for real-time system's monitoring.

Build your own scooter with an interdisciplinary team of WUST experts.
FACULTY OF MECHANICAL ENGINEERING

You will learn about the design (CAD) of the supporting structures of the urban scooters. Pedestrian safety will be discussed during the workshops. The workshops will include a lecture part; where you will learn about the recent advances

in strength calculation methods, principles of material selection and durability prediction and damage risk analysis of the complex structures. In the practical part of the course, you will have an opportunity to design the scooter in the numerical environment, supported by some reverse engineering equipment, with practical workshops. Then, each participant can create a part of the scooter. Due to the main goal of the course – lightweight design, it will be recommended to build during the workshop a scooter part made of composite materials like GFK or CFK. Finally, the participant will be acquainted with composite manufacturing methods. It is also planned to carry out the destructive tests of the sub-structure prototypes and then analyse them with the numerical methods. Lectures will be delivered by invited experts in the following fields: numerical methods in mechanics and engineering design, reliability and safety analysis, strength calculation methods, mechanical and composite material engineering, biomechanics.

³e+ MEMS and mechatronic systems with LabVIEW
FACULTY OF MICROSYSTEM ELECTRONICS AND PHOTONICS

New types of microscopic sensors and actuators are made using technology of micro-electro-mechanical systems (MEMS). MEMS devices are organized into mechatronic systems, which can measure signals and perform mechanical actions, so they are crucial components in automotive, biomedical and electronics applications. But how to build and manage MEMS & mechatronic systems? Use LabVIEW! It is the world's most popular graphical engineering software for measurements, control, data processing and testing. LabVIEW-based systems are applied in almost every branch of engineering, including: manufacturing, electronics, energetics, transportation, science, and aerospace. In this course you will learn how to control exemplary mechatronic system with own-developed LabVIEW application with a graphical user interface.

It's a MEMS, MEMS world…
FACULTY OF MICROSYSTEM ELECTRONICS AND PHOTONICS

Have you ever wondered what are the sensors on a plane and how small they are? How to print a miniature clock mechanism? Or how to analyse DNA in a few minutes? This is the field of miniature devices, called micro-electro-mechanical systems (MEMS) or simply microsystems. During this course you will learn what they are, but also you will touch them and measure some of their properties. Take part in this course to see microengineering laboratory, find how microfluidic pumps are working, measure parameters of avionic sensors, discover miniature transducers for energy harvesting, as well as testing of miniaturized devices, such as different lab-on-chips or an electron sources, that cover various and selected aspects of human and animal health monitoring.

Introduction to Data Science with Python
FACULTY OF PURE AND APPLIED MATHEMATICS

According to CareerCast, Data Scientist is one of the best jobs of recent years. It requires a unique blend of skills from three disciplines: mathematics (especially statistics), computer science (especially data analysis) and domain knowledge (in the field it will be applied), which is very attractive to many employers. Strong computer science skills and different approach to data analysis, based on scientific method, is what makes Data Scientists different from statisticians. At the same time, Python is becoming a language of choice for many data scientists, next to languages like Scala and statistical packages like R. It is also the first programming language many people learn, no no matter how old they are. This course gives you a chance to quickly build up your Python skills, learn basics of how data scientist works and apply all this to a project on a real, large data sets.

3e+ Offer

Anomalous diffusion models with application to biological data

FACULTY OF PURE AND APLIED MATHEMATICS.

Movement of the particles in a cell is a very complex dynamical process resulting from an intricate interplay of multiple components. At first sight, the trajectories of migrating particles resemble those of thermally driven Brownian particles. However, by analyzing the trajectories of various particles, one can empirically show that anomalous dynamics characterizes such movements. In fact, the characteristic properties of such anomalous diffusion can indicate differences between types of particles. Often, it is even possible to detect the presence of some extracellular component, e.g. a medication. To describe such anomalous dynamics, or the, so called, anomalous diffusion, one can use many different types of stochastic processes. Get an insight into mathematical and applicational background in this topic. learn how to simulate considered models, estimate their properties and fit these models to real biological systems.

Graphs and their Applications

FACULTY OF PURE AND APPLIED MATHEMATICS

Graphs are mathematical objects playing an important role in modeling various complex systems. They have numerous applications in many branches of knowledge, including computer science, Big Data, social sciences and networks, biology, chemistry, physics, linguistics and many others. The purpose of this course is to give mathematical foundations of graph theory and show some of their applications. The theoretical part will include: basic notions and theorems in graph theory, elementary graph properties, Euler's Theorem, paths, walks and cycles, bipartite graphs, acyclic graphs and trees, planar graphs, directed graphs, random graphs and graph colorings. Applications will include: map colorings, minimum spanning tree algorithm, Dijkstra's shortest path algorithm, sorting algorithms and random graph simulations.

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ENVIRONMENT + ENERGY + ELECTRONICS

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IN POLAND – WROCLAW UNIVERSITY OF SCIENCE AND TECHNOLOGY!

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