



AZƏRBAYCAN RESPUBLİKASI  
TƏHSİL NAZIRLIYI



Azərbaycan Respublikası  
Mədəniyyət Nazirliyi



ƏLƏMLƏRİYYAT NAZIRLIYI  
BİLƏM VERİLƏRİYYAT NAZIRLIYI  
INFORMATION TECHNOLOGIES  
MINISTRY OF EDUCATION AND SCIENCE  
REPUBLIC OF AZERBAIJAN



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# FIRST ICESCO WORKSHOP ON FUNDAMENTALS OF INSTRUMENTATION & REVERSE ENGINEERING

OCTOBER 4 - 7, 2021

BAKU STATE UNIVERSITY | BAKU, AZERBAIJAN

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## COVID-19 GUIDELINES FOR WORKSHOP PARTICIPANTS

Baku State University, as host organization recognizes the importance of our staff's and workshop participants' safety. The following guidelines are listed below, to minimize the risk of infection to the virus **COVID-19**:

- If you are sick with **COVID-19** or showing symptoms, have been exposed to someone with **COVID-19** diseased, have travelled outside of the Republic of Azerbaijan in the last 14 days, or feeling unhealthy, you are NOT able to attend this Workshop;
- Kindly arrive 20 minutes early for training to allow for pre-screening;
- You are required to follow guidelines related to **COVID-19** on the training rooms on the premises;
- You will be asked to use hand sanitizer and to pass temperature measurement control before entering the facility;
- Follow social distancing rules with another workshop participants;
- Greet others while maintaining a distance, without shaking hands;
- It is important medical masks will be worn on the premises. You are encouraged to bring your own mask or one will be provided for you;
- If you need to cough or sneeze, do so into the inside of your elbow or cover your mouth and nose with tissues, directed away from others;
- A maximum of 4 (four) persons will be allowed in one table in the training room and canteen at same time;
- All training materials and other printed materials remain in place for the duration of the training including overnight for all days of Workshop and must be taken home by you after the workshop is over;
- You are encouraged to have safe food and drinks during Workshop. Don't offer any food or drinks to other participants.
- Do not bring unnecessary items, food and drinks into the building to avoid possible cross contamination.

While the Baku State University has taken measures to minimize the risk of viral contamination, it is your responsibility to keep yourself safe by following these guidelines.

By signing this protocol you indicate that you agree to the **COVID-19** guidelines and release the Baku State University of any liability if you were to contract **COVID-19** through your participation.

**Thank you for your understanding during these incredibly trying times!**

## ABOUT WORKSHOP

Workshop organized by	ICESCO – Islamic World Educational, Scientific and Cultural Organization
In Collaboration with	<ul style="list-style-type: none"><li>• Azerbaijan National Commission for ICESCO</li><li>• Baku State University (BSU), Baku, Azerbaijan</li></ul>
Workshop Contact Persons	El Ayni Foued (ICESCO), Mais Suleymanov (BSU)
Workshop Inquiry Email ID	<a href="mailto:falayni@icesco.org">falayni@icesco.org</a> ; <a href="mailto:mais.suleymanov@bsu.edu.az">mais.suleymanov@bsu.edu.az</a>
Workshop Website	<a href="http://fire2021.bsu.edu.az/">http://fire2021.bsu.edu.az/</a>

### Important Dates

Announcement of the Workshop program	September 1, 2021
Workshop Dates	October 4 – 7, 2021

ICESCO – Islamic World Educational, Scientific and Cultural Organization in collaboration with the Baku State University organises “**1<sup>st</sup> ICESCO WORKSHOP ON FUNDAMENTALS OF INSTRUMENTATION & REVERSE ENGINEERING**” on 4 - 7 October, 2021, in Baku, Azerbaijan.

The purpose of the Workshop is to introduce to basic ideas employed in the instrumentation, use of various kinds of sensors, acquiring data and its processing. Most of modern laboratory instruments are either electro-mechanical or purely electronic or electro-optical. These employ various kinds of sensors (e.g., temperature, pressure, optical, electrochemical or chemical), than transducers, which convert the sensed signals into electrical. The microcontrollers the processing the signals (in digitized format) and either display the result or control the instruments through actuators. The data is in the form of either analog or digital signals. A microcontroller or a microprocessor process the data and control the systems. In the first Workshop, we plan to introduce basic components instrumentation and participants will be trained to acquire signals from sensors and learn to control through microcontrollers.

The Workshop comprise of combination of lectures and hands on training. It is designed in such a way that it will have lectures in one part and training in the second part. The participants introduced with the basics of instrumentation, its components and requirement for a specific systems.

## **WORKSHOP TOPICS & SUBJECTS**

As it was mentioned above, the Workshop will comprise of combination of lectures and hands on training. It is designed in such a way that it will have lectures in one part and training in the second part. The participants will be introduced with the basics of instrumentation, its components and requirement for a specific systems. It will be followed by basics of input/output signals, analog to digital (ADC) and digital to analog (DAC) controllers, microcontrollers, sensors and actuators. In the end some very simple instruments like temperature controllers, hot plate, electrical measurement systems, etc. will be developed for the participants by the participants. The Workshop will conclude with an emphasize on calibration and industrial standardization of laboratory instruments. Following topics will be covered in the Workshop in a systematic manner so participants will learn the basic tools to develop laboratory instruments:

- Key components of modern instruments in a laboratory or workplace;
- System requirements and key components;
- Mechanical and vacuum systems;
- Sensors and actuators;
- Microcontrollers and FPGAs basics;
- Interfacing and data acquisition;
- Development of simple instruments;
- Industrial standards in instrumentation.

### **Subjects:**

- Instrumentation fundamentals and small instruments development;
- Biomedical equipment/instruments: Fundamentals and design aspects ;
- Advanced instruments: Diagnostics and repair.

## COMMITTEES

### Workshop Chairmen

- Raheel Qamar (Head of Science and Technology Sector, ICESCO)
- Elchin Babayev (Rector, Baku State University)

### Scientific-Technical Organizing Committee (STOC)

No	Full name	Affiliation
1	Muhammad Sharif (Chair)	Advisor of Science and technology sector of ICESCO
2	Vasif Eyvazzadeh	Head of Administration at Ministry of Culture of the Republic of Azerbaijan, Secretary General of the National Commission for ICESCO in Republic of Azerbaijan, Azerbaijan
3	Nijat Mammadli	Head of the science, higher and secondary education department at the Ministry of Education of the Republic of Azerbaijan, Azerbaijan
4	Arshad Saleem Bhatti	Rector of Virtual University of Pakistan, Pakistan
5	Huseyn Mammadov	Vice-rector for science and innovations of Baku State University, Azerbaijan
6	Ahmet Oral	Professor of Middle East Technical University, member of the Science Academy, Turkey
7	Aydin Kazimzadeh	Rector's advisor for science and education of Baku State University, Azerbaijan
8	Ali Naghiyev	Rector's advisor for strategic development and relations of Baku State University, Azerbaijan
9	Mais Suleymanov	Director of Center for Organization of scientific activity and innovation, Baku State University, Azerbaijan
10	Foued Elayni	Event-science expert, ICESCO
11	Sadiyar Rahimov	Director of Research Institute for Physical Problems of Baku State University, Azerbaijan
12	Mustafa Muradov	Deputy Director of Excellence Center for Research, Development and Innovations, Baku State University, Azerbaijan
13	Ismat Shah	Professor in Materials Science and Engineering, University of Delaware, USA
14	Stefano Bellucci	Head of NEXT Nanotechnology Laboratories of National Institute for Nuclear Physics, Italy
15	Hiroataka Ihara	Professor of Applied chemistry and biochemistry at Department of Kumamoto University, Japan
16	Umar Ansari	Mechatronics engineer at South Wales University, South Wales

17	Mohsin Islam Tiwana	Mechatronics engineer and associate professor of National University of Sciences and Technology, Pakistan
18	Bilal Shahid	Mechatronics engineer of National University of Sciences and Technology, Pakistan

### Local Organizing Committee (LOC)

No	Full name	Affiliation
1	Mahir Pirguliyev (Chair)	Head of Rector's Secretariat, Baku State University
2	Marziya Aghayeva	Head of Research and development department, Azerbaijan Technical University
3	Elvin Yusibov	Lecturer at the Department of device engineering, Azerbaijan State Oil and Industry University
4	Hamed Kagazchi	Senior Lecturer at the Department of automation and electric power engineering, Baku Engineering University
5	Vusal Mammadov	Deputy dean for academic affairs, Faculty of Physics, Baku State University
6	Ilyas Nasibov	Director of Students' Scientific-Technical Creativity Center, Baku State University
7	Nurlan Amrahov	Senior laboratory assistant of Department of Molecular biology and biotechnology, Faculty of Biology, Baku State University
8	Alibala Aliyev	Junior researcher of Industrial chemistry scientific research laboratory, Faculty of Chemistry, Baku State University
9	Elshan Nasirov	Senior researcher of the Department of condensed matter physics of the Institute for Physical Problems, Baku State University
10	Ofeliya Balayeva	Lecturer at the Department of Chemistry of high molecular weight compounds, Faculty of Chemistry, Baku State University

## INVITED SPEAKERS

The resource team consists of following invited speakers, each has more than 10 years of experience in instrumentation, diagnostic, repair and development.



**Prof. Dr. Ahmet Oral** has received his PhD degree in 1994 from Bilkent University, Physics. Areas of Interest : Scanning Probe Microscopy: non-contact Atomic Force Microscopy, Scanning Hall Probe Microscopy, Graphene Hall Sensors and devices. Prof. Dr. Ahmet Oral is member of The Science Academy, Turkey and receipient of TÜBİTAK Research and Encouragment award. He is the founder of NanoMagnetics Instruments Ltd.



**Prof. Dr. Arshad Saleem Bhatti** is Rector of Virtual University of Pakistan. Prior to this assignment, he was Dean, Faculty of Science at COMSATS University Islamabad. He holds a PhD degree in Microelectronics & Optoelectronics from the University of Cambridge, Cambridge UK. He has more than 125 research articles in peer reviewed journals and 4 US patents. His interest in developing instruments led to the foundation of Nano laboratory at COMSATS University Islamabad.



**Dr. Umar Ansari** received his PhD degree in 2014 from University of New South Wales (UNSW), Australia, and BE in Mechatronics Engineering from NUST. He has expertise in the area of Robotics, Sensors and Mechatronic Systems. He has published over 25 articles in top-tier journals and conferences and also has eight patents to his credit. He has also worked on different industrial automation projects providing solutions to the local defence, textile, medical device and telecom industry.



**Dr. Mohsin Tiwana** is an Associate Professor in NUST. In 2013, he was awarded the prestigious Technology Transformer of the Year Award by CRDF Global, USA. In 2015, he was conferred with Presidents Gold Medal for Innovation & Commercialization & was also awarded the National Excellence Award. At IROS 2016, he was runners up in Robotics Entrepreneurship Forum. Dr Tiwana has been a guest speaker at Harvard, MIT, Stanford and many other prestigious organizations. Systems designed by him are currently used in over 27 countries including United States, Australia, Japan, and Germany.



**Mr. Bilal Shahid** is CEO Tek Nuclei. He did his BE in Mechatronics Engineering from NUST in 2007. His company is involved in designing high end electromechanical solutions for Defence and Public sector organisations (Universities). The company is at forefront at developing indigenous Test Benches for various organisations of Pakistan.



# “1<sup>st</sup> ICESCO WORKSHOP ON FUNDAMENTALS OF INSTRUMENTATION & REVERSE ENGINEERING”

4<sup>th</sup> – 7<sup>th</sup> October, 2021

Baku State University | Baku, Azerbaijan

## PROGRAMME

Monday, 4 October 2021		
Time	Meeting	Location
From 08:30 am	<b>Registration of participants</b>	Hall (new building)
<b>Keynote Lecture: Introduction to Instrumentation and Importance</b>		
09:00 am – 09:30 am	Lecturer 1: Prof., Dr. Ahmet Oral Lecturer 2: Prof., Dr. Arshad Saleem Bhatti	
	Brief introduction about instrumentation and importance on instrumentation in commercial and industrial equipment	Training room (new building)
	<b>Basics of Instrumentation</b> Lecturer: Dr. Umar Ansari	
09:30 am – 10:20 am	Type of readable signals, Signal conditioning and amplifications	
	<b>Analog to Digital Conversion</b>	
10:20 am – 11:00 am	Lecturer: Dr. Umar Ansari A to D conversion and available converters	
11:00 am – 11:20 am	Coffee/Tea Break	Hall (new building)
11:20 am – 12:50 pm	<b>Opening Ceremony</b>	Assembly Hall (main building)
12:50 pm – 13:00 pm	Group photo	In front of main building
13:00 pm – 14:00 pm	Lunch	Near Assembly Hall
	<b>Demo of A-D Converter</b> Lecturer: Dr. Umar Ansari	
14:00 pm – 14:20 pm	Arduino demo of A-D Conversion	Training room (new building)
14:20 pm – 15:00 pm	<b>Types of Sensors</b> Lecturer: Dr. Mohsin Tiwana	

Sensor type and instrumentation		
<b>Interfacing of Sensors</b>		
15:00 pm – 15:30 pm	Lecturer: Dr. Mohsin Tiwana	
Interfacing and Calibrations (Example of Temperature Sensor)		
15:30 pm – 15:50 pm	Coffee/Tea Break	Hall (new building)
<b>Introduction to Actuators</b>		
Lecturer: Mr. Bilal Shahid		
15:50 pm – 16:30 pm	Type of Actuator (AC & DC Motors, Pumps, Solenoids, Linear Actuators)	
<b>Controls of Actuators</b>		
Lecturer: Mr. Bilal Shahid		
16:30 pm – 17:00 pm	Types of Actuators Controller, Concept of feedback	Training room (new building)
<b>Practical example of Actuator based system</b>		
Lecturer: Mr. Bilal Shahid		
17:00 pm – 17:40 pm	Actuator based system with sensor feedback (Example of a Blood pressure apparatus)	
17:40 pm	Adjourn	

Tuesday, 5 October 2021		
Time	Meeting	Location
10:00 am – 10:30 am	<b>Introduction to Microcontrollers</b> Lecturer: Dr. Mohsin Tiwana	
Brief introduction about Microcontrollers and its Architecture and usage in different electro-mechanical systems		Training room (new building)
10:30 am – 11:20 am	<b>AVR Architecture and Arduino</b> Lecturer: Dr. Mohsin Tiwana	
Introduction to Arduino		
11:20 am – 11:40 am	Coffee/Tea Break	Hall (new building)
11:40 am – 12:40 pm	<b>Arduino IDE</b> Lecturer: Dr. Umar Ansari	
IDE introduction, First program. Hands on Arduino Software		
12:40 pm – 13:00 pm	<b>Hardware integration</b> Lecturer: Dr. Umar Ansari	Training room (new building)
Types of interfacing/communication protocols		
13:00 pm – 14:00 pm	Lunch	Near Assembly Hall

14:00 pm – 14:30 pm	<b>A glimpse of IoT</b> Lecturer: Dr. Umar Ansari	
	Introduction to Internet of Things	Training room (new building)
14:30 pm – 15:30 pm	<b>Practical Work</b> Prof., Dr. Arshad Saleem Bhatti	
	Arduino implementation of a practical design problem	
15:30 pm – 15:50 pm	Coffee/Tea Break	Hall (new building)
15:50 pm – 17:50 pm	<b>Practical Work (Continued)</b> Prof., Dr. Arshad Saleem Bhatti	Training room (new building)
	Arduino implementation of a practical design problem	
17:50 pm	Adjourn	

Wednesday, 6 October 2021		
Time	Meeting	Location
09:00 am – 09:30 am	<b>Introduction to basic concept of Reverse Engineering</b> Lecturer: Dr. Mohsin Tiwana	
	Introduction to reverse engineering	
09:30 am – 10:20 am	<b>Reverse Engineering in Mechanical Processes</b> Lecturer: Mr. Bilal Shahid	Training room (new building)
	Mechanical Processes in redesigning a product	
10:20 am – 10:50 am	<b>Material Identification and Selection for a Product</b> Lecturer: Mr. Bilal Shahid	
	Material identification and Selection for different applications	
10:50 am – 11:10 am	Coffee/Tea Break	Hall (new building)
11:10 am – 11:50 am	<b>Reverse Engineering in Electrical Processes</b> Lecturer: Dr. Mohsin Tiwana	
	Electrical Processes in redesigning a product	Training room (new building)
11:50 am – 12:30 pm	<b>System Integration and Product Packaging</b> Lecturer: Dr. Mohsin Tiwana	
	Over all integration of a product and packaging	
13:00 pm – 14:00 pm	Lunch	Near Assembly Hall
14:00 pm – 15:30 pm	<b>Practical Work</b> Dr. Umar Ansari	Training room (new building)
	Redesigning of a commercial product	

15:30 pm – 15:50 pm	Coffee/Tea Break	Hall (new building)
15:50 pm – 17:20 pm	<b>Practical Work (Continued)</b> Dr. Umar Ansari	Training room (new building)
	Redesigning of a commercial product	
17:20 pm	Adjourn	

<b>Thursday, 7 October 2021</b>		
<b>Time</b>	<b>Meeting</b>	<b>Location</b>
09:00 am – 11:00 am	<b>Presentations from the participants</b>  Participants presenting their practical work	Training room (new building)
11:00 am – 11:20 am	Coffee/Tea Break	Hall (new building)
11:20 am – 12:00 pm	<b>Closing ceremony</b>  - Presentation of the participation certificate - Prize distribution to outstanding participants - Group photo	Assembly Hall (main building)
12:00 pm – 13:00 pm	<b>Cultural Event</b>	
15:00 pm – 17:00 pm	<b>Meeting of the Steering Committee of Workshop</b>  - Concluding remarks - Outcomes of Workshop	Council room (main building)

## LIST OF PARTICIPANTS

No	Full name	Affiliation
1	Ali Allahveranov	Laboratory assistant of Telecommunications and radio engineering, Electronics Faculty, Baku Engineering University
2	Alibala Aliyev	Researcher of Industrial Chemistry scientific research laboratory, Chemistry Faculty, Baku State University
3	Alakbar Valizada	PhD in Systematical analysis, management and information processing, Azerbaijan Technical University
4	Anar İsmayilov	Senior lecturer of Chair of Computer technologies and cyber security, Azerbaijan Technical University
5	Aytan Mammadova	BSc student of Applied Mathematics and Cybernetics Faculty, Baku State University
6	Elvin Bakhtiyarli	BSc student of Physics Faculty, Baku State University
7	Elshan Guliyev	Employee of Internet Technology Department of the Information Technology Center, Baku State University
8	Fagan Amanullazada	BSc student of Engineering Faculty, Baku Engineering University
9	Farid Habibbayli	BSc Student of Applied Mathematics and Cybernetics Faculty, Baku State University
10	İlkin Karimli	BSc student of Applied Mathematics and Cybernetics Faculty, Baku State University
11	Ilyas Nasibov	Director of Students' Scientific-Technical Creativity Center, Baku State University
12	İsa İsayev	BSc student of Chemistry Faculty, Baku State University
13	Kamil Ahmadov	Senior laboratory assistant of Chair of Computer and Information Technology, Baku Engineering University
14	Kamran Aliyev	Assistant of Chair of Instrumentation Engineering, Azerbaijan State Oil and Industry University
15	Kanan Hasanov	MSc student of Physics Faculty, Baku State University
16	Lala Gadimova	MSc student of Biomedical technology engineering, Azerbaijan Technical University
17	Lala Gahramanli	Junior researcher of Nano Research Laboratory, Baku State University

18	Mahammad Yusifov	MSc student of Chair of Instrumentation Engineering, Faculty of Information Technology and Control, Azerbaijan State Oil and Industry University
19	Malakkhanim Mehraliyeva	BSc student of Biology Faculty, Baku State University
20	Mustafa Azadov	MSc student of Physics Faculty, Baku State University
21	Nigar Ahmadova	BSc student of Physics Faculty, Baku State University
22	Nargiz Mammadzada	Lecturer of Chair of Artificial intelligence and Mathematics, Azerbaijan Technical University
23	Nurlan Amrahov	Laboratory assistant of Chair of Molecular Biology and Biotechnology, Biology Faculty, Baku State University
24	Orkhan Aliyev	Lecturer and technical researcher of Chair of Instrumentation Engineering, Information Technology and Control Faculty, Azerbaijan State Oil and Industry University
25	Orkhan Gülahmadov	Laboratory assistant of Nano Research Laboratory, Baku State University
26	Rahim İsmayilov	BSc student of Applied Mathematics and Cybernetics Faculty, Baku State University
27	Rahim Mammadzada	BSc student of Computer information and measuring technologies, Azerbaijan State Oil and Industry University
28	Sevinj Mammadyarova	Junior researcher of Nano Research Laboratory, Baku State University
29	Shahla Aliyeva	PhD of Chair of Computer technologies and cyber security, Azerbaijan Technical University
30	Simara Maharramli	BSc student of Applied Mathematics and Cybernetics Faculty, Baku State University
31	Sara Rahimzada	Senior laboratory assistant of Institute for Physical Problems, Baku State University
32	Turan Alasgarli	MSc student of Information and control in technical systems, Azerbaijan Technical University

## WORKSHOP VENUE

<b>Location:</b>	Baku State University, Baku, Azerbaijan
<b>Address:</b>	Academic Zahid Khalilov street, 33
<b>Tel.:</b>	(+994 12) 430 32 45, (+994 12) 439 05 17
<b>e-mail:</b>	<a href="mailto:info@bsu.edu.az">info@bsu.edu.az</a>



Scan for location on Google Maps :



## CONTACT US

### Conference Secretary

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## NOTES

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