

Instrumentation Engineering (INEN) program, “Instrumentation Engineering” department

Course Unit Title	Analytic Devices	
Course Unit Code	VTES-B02-1	
Type of Course Unit	Elective	
Level of Course Unit	3 th year INEN program	
National Credits	0	
Number of ECTS Credits Allocated	8	
Theoretical (hour/week)	2	
Practice (hour/week)	2	
Laboratory (hour/week)	2	
Year of Study	3	
Semester when the course unit is delivered	5	
Course Coordinator	Hasanova Gunay	
Name of Lecturer (s)	Hasanova Gunay	
Name of Assistant (s)	-	
Mode of Delivery	Face to Face	
Language of Instruction	English	
Prerequisites	-	
Recommended Optional Programme Components	-	
Course description:		
<p>The Analytical Instrumentation course provides students with the knowledge and skills to understand and apply various instruments used in analytical techniques. This includes devices for chemical, biological, and physical measurements. Topics covered include spectroscopy, chromatography, electrochemical analysis. Students will also learn the principles of sensor technology, data acquisition, and interpretation of measurement results.</p>		
Objectives of the Course:		
<p>The main objective and purpose of the course are to understand the principles behind common analytical instrumentation techniques. Identify and describe the construction, working principles, and applications of different analytical instruments. Understand the role of analytical instrumentation in modern research and industrial applications.</p>		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1.	To learn general information about physico-chemical measurements, quality control and Methods and means of laboratory and automatic measurements.	1,3
2.	The ability of general concepts about shikhlik. Ability to classify liquids and gases density measuring instruments.	2
3.	Can identify the principles of viscosity measurement. The dependence of viscosity on temperature. means of measuring viscosity	3
4.	Measurement of the refractive index of liquids. Measurement of saturated vapor pressure, Measuring the combustion temperature of liquid and gaseous fuels	3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam		
Course’s Contribution to Program		
		CL
1	Ability to develop as a specialist in the field of fundamental sciences and apply basic knowledge.	4
2	Ability to analyze and model functional and structural schemes of various purpose devices and systems.	3
3	Ability to use modern methods and tools, creation, selection, and application of engineering and information technology tools and modern devices and equipment.	4
4	The ability to use the strategy of team cooperation in the exchange of information, knowledge, and experience to achieve the set goal.	5
5	As a result of training, the ability to use engineering knowledge, mathematical models, and basic concepts of physics and chemistry in production and technological processes, automation,	4

	measurement, and control systems.	
6	The ability to use modern software to process technical documents of devices, design their structures, and algorithmize processes.	4
7	The ability to apply artificial intelligence to improve the quality characteristics of measurement and control systems.	1
8	The ability to process information acquisition, processing, and transmission processes based on schematic and programmable logical integrated circuits.	3
9	Ability to use knowledge to improve quality indicators and environmental safety of production processes.	4
10	Self-development ability to apply theoretical and experimental knowledge in solving modern engineering problems.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[4], Ch. 1, p. 1-25	LECTURE: General information about analytical devices. Laboratory and automatic analyzers	
2	[2], p. 10-30 [4], Ch. 4, p. 45-70	LECTURE: Density of liquids and gases. Density measurement methods and tools	
3	[3], p. 5-18 [4], Ch.8, p180-205 [8], Ch. 6, p. 75-95	LECTURE: Viscosity of liquids and gases. Viscosity measurement methods and tools	
4	[4] Ch. 9, p210-245 [5], p. 40-60 [6], Ch.7, p150-170	LECTURE: Spectrophotometry	
5	[4], Ch7, p.140-160 [5], p. 80-100	LECTURE: Saturated vapor pressure of liquids. Methods and means of its measurement	
6	[4], Ch.12, p300-320 [7], Ch. 2, p. 30-55	LECTURE: Measurement of combustion heat of fuels	
7	[4], Ch14, p340-360 [8], Ch. 10, p. 150-170 [9], p. 50-75	LECTURE: Gas analyzer LAB- Development of an Analog to Digital Converter	Midterm
8	[8],Ch.12, p 200-220 [6], Ch5, p. 90-110	LECTURE: Dielectric, optical, flame-ionization, photometric automatic concentration analyzers	
9	[4], Ch. 10, p. 245-270 [6], Ch. 8, p. 170-190	LECTURE: Measurement of the composition of liquids and gases. Chromatographic analysis method.	
10	[4], Ch.15, p.370-400 [5], p. 100-120	LECTURE: Basic blocks of the chromatograph, analysis of the chromatogram.	
11	[4], Ch. 16, p. 410-440 [5], p. 120-140	LECTURE: Ignition temperature, octane number indicators, methods and means of their determination	

12	[4], Ch. 20, p. 450-475 [7], Ch. 5, p. 65-85	LECTURE: Nuclear magnetic resonance and radiation techniques	
13	[6], Ch 15, p.10; [4], Ch. 25, p. 500-520 [5], p. 150-170	LECTURE General information on quality indicators of oil and oil products.	
14	[4], Ch. 1, p. 1-25	LECTURE: General information about analytical devices. Laboratory and automatic analyzers	
15	[2], p. 10-30 [4], Ch. 4, p. 45-70	LECTURE: Density of liquids and gases. Density measurement methods and tools	
16			Final exam

Recommended Sources

TEXTBOOK(S)

1. APJ Abdul Kalam Technological University/Study Materials/www.ktuassist.in
2. Density measurement basics/Training document (MEMS-CHIP)
3. <https://sciencing.com/viscosity-definition-unit-formula-13723389.html>
4. Analytical Instrumentation /Department of Electronics and Instrumentation Engineering University U/S 3 of UGC Act 1956 / . R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing.Co. Ltd., 5 edition, 2018
5. Analytical Instrumentation – SEIA 1505/School of electrical & Electronics engineering department of electronics & Instrumentation engineering
6. Issam Abu-Mahfouz, Instrumentation: Theory and Practice, Part 1 Principles of Measurements, Springer Nature, Switzerland AG, 2022 <https://doi.org/10.1007/978-3-031-15246-7>
7. Mini S. Thomas, John D. McDonald, "Power System Scada and Smart Grids", CRC Press, Taylor & Francis Group, USA, 2015, <https://doi.org/10.1201/b18338>
8. Tony R. Kuphaldt, "Lessons In Industrial Instrumentation", licensed under the Creative Commons Attribution 4.0 International Public License, California, USA 2022. <https://www.ibiblio.org/kuphaldt/socratic/sinst/book/liii.pdf>
9. Miguel F. Acevedo, "Real-Time Environmental Monitoring-Sensor and Systems", Taylor & Francis Group, 2016, USA

Additional information will be distributed either electronically or delivered in printed forms.

Assessment

Attendance	0%	Less than 75% class attendance results in NA grade
Presentation	10%	
Lab. works	10%	
Course work	0%	
Quiz	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for undergraduate studies

Course Policies

1. Attendance of the course is mandatory.
2. Material presented in the lecture as well as assigned readings will be included in testing.
3. Late assignments will not be accepted unless an agreement is reached with the lecturer.
4. Cheating and plagiarism will not be tolerated.

5. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class (including midterm)	15	5	75
Presentation	1	10	10
Self-study	15	4	60
Tutorials	15	4	60
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			241
Total Workload/30(h)			8.03
ECTS Credit of the Course			8