Instrumentation engineering (INEN) program, "Instrumentation engineering" department

Course Unit Title	Electronics and Circuit Design
Course Unit Code	VTSS-B12
Type of Course Unit	Compulsory
Level of Course Unit	2nd year INEN program
National Credits	6
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	2
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Yusubov Elvin
Name of Lecturer (s)	Yusubov Elvin
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Electronics and Circuit Design of measurement devices is the study of how to control the flow of electrons. It deals with circuits made up of components that control the flow of electricity. Electronics is a part of physics and electrical engineering. Electrical components like transistors and relays can act as switches.

Objectives of the Course:

The main objective and purpose of the course are to teach future instrumentation engineers the main types of electronic components, and their working principles to evaluate, and improve the performance of their technical characteristics.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1.	Describe the basic concepts of diodes.	1,3
2.	Explain how bipolar junction transistors (BJT) work	1,2,3
3.	Explain how field effect transistors (FET) operate, understand the difference between FET and BJT	2,3
4.	Understand advantages of Metal-Oxide Semiconductor Field-Effect Transistors (MOSFET).	2,3
5.	Explain and analyze primary transistor circuits used as amplifiers and switches	1,3
6.	Explain the electronic circuits based on OP-AMPs	1,3
7.	Explain the electronics circuits based on OP-AMPs with negative feedback	1,3
8.	Explain electronic circuits with active and passive sensors	1,3

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	4

	and information technology tools and modern devices and equipment.	
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, measurement, and control systems.	4
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	[1], ch.2, p.1	**LECTURE:** Semiconductor diodes **LAB**: Taking basic measurements with multimeters, function generators and oscilloscopes.	
2	[1], ch.2, p.2,3	**LECTURE:** Analysis of the diode current/voltage characteristics **LAB**: Learning how to build basic voltage divider electronic circuits for the semiconductor diodes on PCB and breadboards.	
3	[1], ch.2, p.4-7	**LECTURE:** Rectifiers and Clippers **LAB**: Building the diode circuit forward and reverse biasing.	
4	[1], ch.3, p.1,2	**LECTURE:** Special-purpose diodes-Zener diodes **LAB**: Obtaining voltage-current characteristic of a semiconductor and zener diode in DC circuits using the multimeters	
5	[1], ch.3, p.3-5	**LECTURE:** Different types special-purpose diodes **LAB**: Building diode limiter and clamper circuit	
6	[1], ch.4, p.1,2	**LECTURE**: Bipolar Junction Transistors (BJT) **LAB**: Building half-wave rectification circuit	
7	[1], ch.4, p.3,	**LECTURE:** BJT Collector Characteristic Curves and Transistor bias circuits **LAB**: Building full-wave rectification circuit	Midterm
8	[1], ch.5,	**LECTURE:** Transistor Bias Circuits **LAB**: Building a transistor bias circuit	
9	[1], ch.8, p.1,2	**LECTURE:** Junction Field-Effect Transistor (JFET) **LAB**: Identification of npn and pnp BJT terminals using a multimeter	
10	[1], ch.8, p.5-7	**LECTURE:** Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) and IGBT **LAB**: Building a BJT and IGBT based switch circuit	
11	[1], ch.12, p.1,2	**LECTURE:** Operational Amplifiers **LAB**: Building a BJT and IGBT based amplifier circuit on a breadboard	
12	[1], ch.12, p.3-5	**LECTURE:** OP-AMPS with negative feedback **LAB**: Building MOSFET Circuits	
13	[1], ch.14, p.1,2	**LECTURE:** Special-purpose OP-AMP amplifiers **LAB**: Building inverting and non-inverting OP-AMP circuits using LM385	
14	[1], ch.11, p.1-3	**LECTURE:** Thyristors- Four layer diodes and SCRs **LAB**: Building diferential OP-AMP circuits using LM385	
15	[1], ch.11, p.4	**LECTURE:** Thyristors-DIAC and TRIAC	

		LAB: Building a thyristor circuit	
16			Final exam

Recommended Sources
TEXTBOOK(S)

1. Thomas Floyd, Electronic Devices , Tenth edition , Pearson Education, 2018
2. Herbert Bernstein, Measuring Electronics and Sensors, Springer, 2022
3. Texas Instruments, A Basic Guide to Thermocouple Measurements, Application Report, 2018
4. Robert Boylestad, Louis Nashelsky, electronic devices and circuit theory, Prentice Hall, 2015

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	10%	
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 İndustry University for undergraduate studies

Course Policies

- Attendance of the course is mandatory.
- Material presented in the lecture as well as assigned readings will be included in testing.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Cheating and plagiarism will not be tolerated.
- 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 (includes midterm)	15	4	60
Presentation	1	7	7
Self-study	15	3	45
Tutorials	15	3	45
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	19	19
Total Workload			189
Total Workload/30(h)			6.3
ECTS Credit of the Course			6