MINISTRY EDUCATION AND SCIENCE
OF THE REPUBLIC OF KAZAHSTAN

SATBAYEV
UNIVERSITY

«Approved»

Omarbekov B.O.
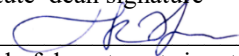   name   Institute dean signature
Ozhikenov K.A.
        name   Head of department signature
                                              23. 08. 2020

Syllabus
ROB1103 Integrated and microprocessor circuitry
(discipline)

For major
6B071600–Instrument making
3 credits

Semester: 5, 2020-2021 year

Almaty, 2020

Institute of industrial automation and digitalization named after A. Burkitbayev
Department of Robotics and Engineering tools of automation

1. About teacher:

Associated professor
Lecturer
Yeshmukhametov Azamat Nurlanovich
Office hours, room (Wednesday 9:00-11:00, IMS 207)
Email yeshmukhametov.coba@gmail.com

2. The purpose of the course:

The purpose of the course is to provide basic knowledge about sensor modules, manufacturing technologies and their application. Objectives of the course - to master the basics of physical operation and devices of semiconductor parts, as well as their characteristics and performance, as well as the basic principles of analog circuits, signal generators, integrated circuits, functions and construction of integrated logic elements, combinatorial and know the methods of synthesis of logic elements.

3. Course description:

The purpose of the discipline is to study electronic phenomena and physical processes related to changes in concentration and location of charged particles in different environments and conditions (at different temperatures, under the influence of electronic and magnetic fields), the principles of construction and operation of electronic devices, their voltage and parameters. To study the principles of construction of logic (digital) circuits in switches, generators and sensor modules.

During the course the student must know:

Must know:

- physical principles, characteristics, indicators and equivalence scheme of sensors;

- standard schematic calculations of generators, pulse signal generators, logic elements and power supply, amplifier circuits;

- the basics of calculation and analysis of electronic circuits.

Must be able to:

- the use of various electronic devices in electrical circuits, the choice of type of electronic devices depending on the specifics of their use;

- use of electronic circuits;

- analyze the operation of electronic circuits, determine their features depending on the function and the conditions of their use;

- work with technical literature, references, ISO and technical documents.

4. Pre-requisites

In order for students to understand and master the course " Integrated and microprocessor circuitry ", they must have knowledge in the following disciplines: Electronics, Mathematics, Electrical Engineering.

5. Post-requisites

The subject " Integrated and microprocessor circuitry " is the basis of the following disciplines: Robotics and mechatronics, Autonomous mobile robots.

6. References

Main references	Additional references
1.Jacob Fraden, "Handbook of Modern Sensors", Second edition. Springer.	Бальян Р . Х. Трансформаторы для радиоэлектроники. М.: Сов. радио, 1971.
2. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, second edition	Типовие устройства экектропитающих установок средств

2006. Wiley press.	связи. Л.: ЛЭИС им. проф. М. А. Бонч-Бруевича, 1977.
3. . Д. Кратиров и др. Электропитание устройств связи: - М.: Радио и свиязь, 1981.	
4. Бурбаева Н.В., Днепровская Т.С. Сборник задач по полупроводниковой электронике (2004).	
5. Китаев В.Е, Бокуняев А. А. Расчет источников электропитания устройств связи:-М.:Связь, 1979	
7.Прянишников В.А. Электроника.- СПб.: Учитель и ученик, 2003.	
8.Степаненко И.П. Основы микроэлектроники. – ДМК Пресс, 2001.	

7. Schedule-topic calendar

Weeks	Lecture titles	Laboratory works	References	Assignment	Deadline
1	Introduction to Arduino. Basics of integrated circuit (IC).	Arduino circuit board explanation	[1-5]		
2	Arduino LED wiring and IC electronic components. Basic programming.	LED wiring and control	[1-6]		
3	Arduino I^2C communication port and serial communication.	Serial.print and Serial.println.	[1-6]	Serial.print and Serial.println.	5
4	Arduino communication interface port. Inputs and outputs. Digital and analogue pins.	Analogue, and digital inputs and outputs.	[3,7]	Potentiometer Arduino wiring and coding	7
5	Arduino potentiometer control.	Potentiometer Arduino wiring and coding	[1,8]		
6	Arduino Bluetooth communication	Wiring of Bluetooth module to the board	[1,8]		
7	Arduino analog input explanation	Arduino joystick control	[2,5]		
8	Midterm			Test multiple choice	Week 8
9	Arduino programming loop. LED based rotating matrix. LED cube.	Designing of LED matrices	[5]		
10	Arduino relay module	Wiring of relay	[2]	Designing of LED	13

Weeks	Lecture titles	Laboratory works	References	Assignment	Deadline
	explanation and application	to the breadboard		matrices	
11	Arduino motor shield and drivers.	Motor wiring and control	[2]		
12	Arduino Wi-Fi and internet shield. ESP32 modules.	Arduino internet or wireless communication	[7]		
13	Arduino display connection and integrated circuit.	Wiring of display	[3]	Wiring of display	14
14	Arduino MIT app inventor explanation.	Designing of app	[8] [5]		
15	**Endterm**			Test multiple choice	Week 15
	Exam			Tickets	By schedule

In schedule-topic calendar might have a changes due to national holidays

8. Assignments and instructions

✓ **Student self-assignment:**
1. Integrated circuit elements
2. Logic control and elements
3. Analogue electronics
4. Digital electronics
5. Capacitive occupancy detectors
6. Relay and their applications
7. Electromagnetic velocity sensors
8. Advantages and disadvantages of integrated circuit
9. IC classifications
10. Monolithic IC
11. Fabrication of IC

✓ **Students assignment with teachers:**
1. Wiring of LED and looping
2. Arduino motors wiring and control
3. Arduino display coding and integration with other modules
4. Designing of basic Arduino app.

✓ **Laboratory works:**
The student's practical work is based on a calendar-thematic plan. Practical work is aimed at solving specific problems and developing the structure of the robot based on the foregoing material. All practical work should be performed according to the schedule and formalized according to the standard.

Midterm 1 – Multiple choice test in written form (all passed materails for the first 7 weeks)

Endterm 2 - Multiple choice test in written form (all passed materails for the first 14 weeks)

✓ **Exam**

Covers and summarizes all course material. The exam is carried out on tickets in writing, includes lecture materials, assignment materials, a practical solution to a specific problem. The duration of the exam is 2 academic hours. The written answer must be accurately framed, contain a correct, complete and clear presentation of theoretical material with illustrations by examples, the correct and optimal solution of practical problems strictly in accordance with the task formulated in the examination ticket.

9. Assessment criteria:

№п/п	Type of exam	Max. score for the week	Weeks															Total max scores
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	Activity in lecture discussions	0,5		*	*	*	*	*	*		*	*	*	*	*	*		6
2	Activity in laboratory work discussion	0,5		*	*	*	*	*	*		*	*	*	*	*	*		6
3	Assignments	1,0		*		*		*			*		*		*			6
4	Homework	1,0			*		*		*			*		*		*		6
5	Project work	4,0					*											4
6	Midterm	10,0								*								10
7	Project work	4,0													*			4
8	Assignment	1,0		*		*	*	*			*		*	*	*			8
9	Endterm	10,0															*	10
	Exam																	40
	Total score																	100

It is possible to receive bonus points for completing additional tasks

10. Late submission policy:
Observe the deadlines for the delivery of practical work, CDS, SRSP. If the work is not completed on time, the maximum score will be reduced by 10%.

11. Policy of attending classes
Do not be late and do not miss classes, turn off cell phones during classes, be prepared for classes, punctual and obligatory. If you are forced to miss the midterm control or final exam for valid reasons, you must notify the teacher in advance before the control or exam.

12. Policy of Academic Conduct and Ethics:
Be tolerant, respect other people's opinions. Formulate objections in the correct form. Plagiarism and other forms of dishonest work are not allowed. Prompting and cheating during exams, passing the exam for another student is inadmissible. A student caught falsifying any course information will receive a final grade of "F". Within the framework of training in the discipline, any manifestations of corruption in any form are unacceptable. The organizer of such actions (teacher, students or third parties on their behalf) bear full responsibility for violation of the laws of the Republic of Kazakhstan.

Considered at a meeting of the department (Robotics and Engineering tools of automation), protocol №1 from «_7_»_08_ 2020 year.

Compiled by: *Associated professor*   Yeshmukhametov A.N.