Ala-Too International University
Department of Computer Systems and complexes
Course Syllabus for
2025-2026 academic year
Fall semester

Title of the Course	Architecture of electronic computing machine and computing systems
Course Code	None
Credit	2
Hours in a week	2
Prerequisites	None
Type of the course	Practical
Recommended for	Software of computer engineering and automated systems
Language of instruction	English
Mode of education	Offline
LMS (Learning Management System)	None
LMS enrollment code	None
Online conference room	None
Physical classroom	C103
Lecturer	Nurbekov Mirlan Nurbekovich
Office	H 209
Office hours	Tu 15:00-17:00; We/Th 16:00-17:00; Fr 08:30-17:00
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Course Description

This course provides a foundational understanding of the architecture, components, and functioning of modern electronic computing systems. It introduces students to the core principles of electronics, microcontroller-based system design, and embedded computing. Emphasis is placed on the practical application of engineering concepts through hands-on laboratory sessions using Arduino microcontrollers and various electronic components. Students will learn how computing machines interact with sensors, actuators, and communication modules to perform intelligent tasks. By the end of the course, learners will be able to design, build, and test basic electronic and robotic systems, forming a strong technical foundation for further study in computer engineering, robotics, and embedded systems development.

Student Learning Outcomes (SLOs)

SLO.1. Understand the fundamental principles of electronic computing machine architecture, including microcontroller structure, input/output systems, and data processing mechanisms.

SLO.2. Identify and describe the function of essential electronic components such as resistors, capacitors, sensors, actuators, and integrated circuits.

SLO.3. Demonstrate the ability to design and assemble basic electronic circuits and embedded systems using Arduino microcontrollers and related modules.

SLO.4. Implement control logic and programming techniques to interface sensors, actuators, and communication modules for automation and robotics applications.

SLO.5. Apply systematic troubleshooting methods to identify and correct hardware and software faults in microcontroller-based systems.

SLO.6. Integrate multiple hardware and software components into a cohesive working project, demonstrating an understanding of system architecture and functionality.

SLO.7. Communicate design concepts, document project development, and present functional prototypes effectively in both written and oral formats.

Course Content

Week	Topic	Focus/Lab/Activity
1	Introduction	Course overview, grading, and lab safety. Introduction to electronics, robotics, and demonstration of sample projects.
2	Electricity basics and components	Current, voltage, resistance, Ohm's law. Identify and use resistors, capacitors, LEDs, switches, and potentiometers on a breadboard.
3	Arduino microcontroller architecture	Overview of Arduino Uno, pinout, digital vs. analog pins, power management, microcontroller basics (CPU, memory, I/O). Lab: blink LED, read button input.
4	Sensors and actuators part 1	Input devices: photoresistor, temperature sensor (LM35), DHT11, ultrasonic sensor (HC-SR04). Lab: read sensor values and display on serial monitor.
5	Sensors and actuators part 2	Output devices: buzzer, relay, servo motor, DC motor, RGB LED. Lab: control output devices via code.
6	Interfacing modules and communication	Understanding modules: IR receiver, remote, joystick, 7-segment display, IC 74HC595, LCD display. Lab: Control multiple devices and serial communication.
7	Digital logic and control systems basics	Logic gates, truth tables, microcontroller control flow. Lab: combine inputs (sensors) and outputs (actuators) in logic-based control.
8	Integrated mini project	Students design a small functional system combining sensors and actuators (a smart parking gate and a room temperature monitor)

9	Midterm lab assessment	Students build a working prototype during the lab session using Arduino, sensors, and actuators from prior weeks. Evaluation based on functionality and wiring accuracy.
10	Data acquisition and processing	Collecting, storing, and processing sensor data. Introduction to serial data logging, simple data visualization.
11	Robotics fundamentals	Motors, motor drivers (L298N), movement control, and power management. Lab: build a simple two-wheel robot.
12	Automation and IoT concepts	Introduction to Wi-Fi modules (ESP8266), basic IoT communication. Lab: send sensor data to a simple web interface or serial dashboard.
13	System integration and testing	Combining hardware and software into a complete system. troubleshooting and debugging circuits.
14	Documentation and presentation skills	Documentations for circuit diagrams, code, and project results. Students prepare short presentations or posters for their final projects.
15	Project Work / Consultation Week	Guided project development with instructor feedback. Students finalize their semester projects.
16	Final project demonstration	Students present and demonstrate their final projects.

Grading rubric and assessments

Midterm assessment - Lab Test	100 points
Final project demonstration	100 points
Average = Midterm assessment * 0.4 + Final project demonstration* 0.6	

Course policies and academic integrity

This is a 16-week course instructed by Mirlan Nurbekov. The course instructor reserves the right to make changes to any portion of the syllabus at any time. Any modifications will be communicated in writing to students via the Learning Management System (LMS).

- ➢ Students are expected to communicate with the instructor professionally. Mobile phones, social media, and messaging apps (e.g., WhatsApp) should not be used for course-related inquiries. Instead, students should send emails, post comments in the LMS, or visit the instructor during office hours. All course-related announcements and materials will be shared through the LMS.

- ➢ Attendance is mandatory. Students are expected to attend at least 70% of the course sessions to be eligible for exams. Active participation in lectures, labs, and discussions is strongly encouraged.

- ➢ Students are required to uphold the highest ethical standards in all aspects of the course. Academic dishonesty includes, but is not limited to, cheating on exams, completing work for another student, and plagiarism.

- ➢ Plagiarism is a serious academic offense. To avoid plagiarism:

    - Do not copy words from any source without proper quotation and citation.

    - Do not use ideas, concepts, or opinions from any source without citing the source. This includes technical terms, original views, and key concepts.

    - Paraphrasing is allowed, but the source must be cited correctly, and the original meaning must not be misrepresented.

All cases of academic dishonesty will result in a failing grade for the course and will be reported to the Head of the Management Department for administrative review.

All projects, presentations, essays, and assignments must follow the Harvard referencing style. Submissions must be uploaded to the LMS before the specified deadline.

- Grading and Assessment:
    - Midterm, final, and makeup exams should account for 40–50% of the total course grade, with the remainder coming from projects, presentations, essays, and assignments.

    - To pass the course, students must achieve an average grade of at least 50 points, with a minimum of 40 points on the final exam.

    - Students who do not pass the final exam are eligible for a makeup exam, which carries the same weight as the final assessment.
- Appeals

  Students have the right to appeal grades within three working days from the date grades are announced. Appeals may include reviewing exam papers, requesting re-evaluation, requesting grading rubrics, or notifying the instructor of any errors in grade aggregation. Once the grade submission system is closed, grades cannot be changed.

Main Resources

Horowitz, P. and Hill, W. (2015) *The Art of Electronics*. 3rd edn. Cambridge: Cambridge University Press.

Lee, E. A. and Seshia, S. A. (2017) *Introduction to Embedded Systems: A Cyber-Physical Systems Approach*. 2nd edn. MIT Press.

Banzi, M. and Shiloh, M. (2014) *Getting Started with Arduino: The Open Source Electronics Prototyping Platform*. Maker Media.

Barrett, S. and Massa, A. (2016) *Embedded Systems & Robotics with Open-Source Tools*. 1st edn. San Francisco: No Starch Press.

Bräunl, T. (2021) *Embedded Robotics*. 4th edn. Springer.

Jones, T. and Flynn, A. (2014) *Mobile Robots: Inspiration to Implementation*. 2nd edn. Boca Raton: CRC Press.

Additional Resources

Embedded Controllers Using C and Arduino (2nd edn) Available at: http://www.dissidents.com/resources/EmbeddedControllers.pdf (Accessed: 3 August 2025).

Khan Academy — Electrical Engineering / Electronics Available at: https://www.khanacademy.org/science/electrical-engineering?utm_source=chatgpt.com (Accessed: 13 August 2025).