Kurdistan Regional Government- Iraq
Ministry of Higher Education and
Scientific Research
Soran University

Undergraduate Degree Program Catalogue

(2026-2027)

BSc in Mechatronic and Robotic Engineering Department (MRED)

1) Departmental Vision - دیدی بەش

To be a leading and accredited department in mechatronics and robotics engineering, recognized for excellence in education, research, and technological innovation, and for developing intelligent and sustainable engineering solutions that contribute to industrial advancement, societal well-being, and sustainable development in the Kurdistan Region, Iraq, and beyond.

2) Departmental Mission - پەیامی بەش

The mission of the Mechatronics and Robotics Engineering Department is to provide high-quality interdisciplinary education, practical training, and research in mechatronics and robotics; to prepare competent, innovative, ethically responsible, and lifelong-learning engineers equipped with the knowledge and skills required by the evolving labour market; and to advance research, technological innovation, and collaboration with industry and society in addressing real-world challenges and contributing to industrial modernization, societal well-being, and sustainable development in the Kurdistan Region, Iraq, and beyond.

3) Department Overview - کورتەیەکی گشتگیر لە سەر بەش

The **Mechatronic and Robotic Engineering Department (MRED)**, part of the Faculty of Engineering at **Soran University**, was established to prepare a new generation of engineers for one of the fastest-growing areas of modern engineering. The department reflects the **interdisciplinary nature** of mechatronics and robotics, in which mechanical design, electrical systems, electronics, computer engineering, control, and artificial intelligence are integrated to create **intelligent machines and automated systems**.

1. Academic Philosophy

The department is built on the principle of **learning by doing**. While students gain a strong theoretical background in mathematics, physics, electronics, mechanics, and control theory, equal emphasis is placed on **practical, hands-on training**. Through laboratories, workshops, and projects, students learn how to design, simulate, build, and test robotic and mechatronic systems that can operate in the real world.

- In the early years, students focus on **fundamentals**: electrical circuits, programming, mechanics, and basic robotics.
- In the later years, they progress into **specialized areas** such as industrial robotics, autonomous mobile robots, sensors and actuators, embedded systems, artificial intelligence, and automation.
- A **capstone graduation project** challenges students to integrate knowledge from across the curriculum to design and implement a complete robotic or mechatronic system.

2. Facilities and Learning Environment

The department is equipped with modern laboratories and resources, including:

- **Microcontroller and Embedded Systems Labs –** Featuring AVR, Arduino, and Raspberry Pi, enabling students to develop embedded solutions and integrate sensors, actuators, and control systems.
- **Basic Circuits and Electronics Labs –** Equipped with breadboards, multimeters, oscilloscopes, function generators, and power supplies, providing practical experience in electrical circuits, semiconductor devices, and analog/digital electronics.
- **Electrical Motor Labs and Control Systems–** Include servo, stepper, and induction motors, electronic motor drives, sensors, actuators, and real-time control hardware for implementing feedback, automation, and motion-control experiments.
- **Industrial Automation and HMI Labs –** Featuring PLC programming stations, SCADA interfaces, and HMI panels, enabling students to design and implement industrial control and automation strategies.
- **Industrial Communication and Networking Labs –** Equipped with Ethernet/IP, Modbus, CAN, ProfiNet, and other industrial network modules, enabling students to develop and test reliable communication and networked control systems for industrial applications.
- **Robotics Labs –** Equipped with robotic arms, mobile robots, and automation kits, supporting practical training in robot programming, operation, and system integration.
- **AI, Machine Learning, and Computer Vision Labs –** Provide high-performance computers, cameras, sensors, and AI software tools, allowing students to develop intelligent systems, train models, implement computer vision applications, and test AI-driven robots.
- **Simulation and Design Software –** Access to CAD, CAM, control system modeling, robotics simulation, AI development, and industrial network simulation platforms, enabling virtual design, modeling, and testing of complex mechatronic and robotic systems.
- **Mechanical Design, Prototyping, and Fabrication Workshops –** Include 3D printers, CNC machines, fabrication tools, and assembly stations, allowing students to design and build mechanical components, robot prototypes, and integrated mechatronic systems.

Students benefit from **small-group learning, team-based projects, and practical demonstrations**, which help them connect theory with practice and prepare for real engineering challenges.

3. Regional and Global Role

The department has a dual mission:

- To **serve the Kurdistan Region and Iraq**, where the demand for automation, smart factories, renewable energy, and advanced manufacturing is rapidly growing.
- To prepare students for **global opportunities**, equipping them with skills that are internationally competitive in the fields of robotics, AI, and Industry 4.0.

By producing engineers who can design and apply intelligent machines, the department contributes to the **region's economic development, technological advancement, and industrial modernization,** while also enabling graduates to succeed worldwide.

4. Career and Future Pathways

Graduates of the MRED program are well-prepared for diverse career paths, including:

- **Robotics Engineers** – designing, programming, and deploying industrial and service robots.
- **Automation Engineers** – developing smart factories, automated production lines, and process control systems.
- **Mechatronics Engineers** – integrating mechanics, electronics, and computing for innovative products.
- **Embedded Systems Developers** – working with microcontrollers, IoT, and real-time systems.
- **AI and Intelligent Systems Engineers** – applying machine learning and AI to robotic decision-making.
- **R&D Engineers** – conducting research and development in robotics, AI, mechatronic systems, and automation technologies.
- **Robotics Simulation and Software Engineers** – developing simulation models, virtual prototyping, and digital twin applications.

In addition, graduates may continue with **postgraduate studies (MSc/PhD)** in mechatronics, robotics, AI, or automation in Iraq, Kurdistan, or abroad.

5. Long-Term Vision

The Department of Mechatronic and Robotic Engineering aims to become a **recognized center of excellence** in robotics and mechatronics, fostering innovation, research, and industry collaboration. By combining strong academics, applied projects, and industry partnerships, the department aims to position Soran University as a **leader in robotics and intelligent systems education** in Iraq and the wider Middle East.

6. In summary:

The MRED at Soran University is not just a place where students learn engineering, but it is a hub for innovation, creativity, and problem-solving, where future engineers are trained to build **robots and intelligent systems** that will shape tomorrow's industries and improve human life.

4) Program Educational Objectives (PEOs) - ئامانجە پەروەردەییەکانی پڕۆگرام

Within 4 years after graduation, graduates of the Mechatronics and Robotics Engineering Program are expected to achieve the following Program Educational Objectives:

PEO1 - Professional Engineering Practice:

Apply interdisciplinary engineering knowledge and skills to succeed in mechatronics, robotics, automation, and related engineering fields.

PEO2 - Industrial and Technological Contribution:

Graduates will contribute innovative engineering solutions to industrial, technological, and societal challenges.

PEO3 - Innovation, Professionalism, and Leadership:

Graduates will demonstrate innovation, ethical responsibility, effective communication, teamwork, leadership, and entrepreneurship in professional practice.

PEO4 - Lifelong Learning and Professional Development:

Graduates will pursue lifelong learning and professional development to adapt to emerging technologies and evolving labour-market needs.

5) Program Learning Outcomes (PLOs) - ئاکامەکانی فێربوون

By the time of graduation, students of the Mechatronics and Robotics Engineering Program will be able to:

PLO1 - Engineering Knowledge and Problem Solving:

Apply mathematics, science, computing, and engineering principles to identify, analyze, and solve complex mechatronics and robotics engineering problems.

PLO2 - Engineering Design and Integration:

Design and integrate mechanical, electrical, electronic, control, and computing components into functional mechatronic and robotic systems.

PLO3 - Experimentation and Engineering Tools:

Conduct experiments, analyze and interpret data, and apply appropriate modern engineering tools for modeling, simulation, implementation, and evaluation.

PLO4 - Automation and Intelligent Systems:

Apply control, automation, embedded systems, robotics, and artificial intelligence technologies to develop intelligent engineering systems.

PLO5 - Research, Innovation, and Entrepreneurship:

Apply research, innovation, entrepreneurial thinking, and project-management principles to develop engineering solutions and projects.

PLO6 - Communication, Teamwork, and Career Skills:

Communicate effectively, work in multidisciplinary teams, demonstrate leadership, and apply professional

career skills in engineering environments.

PLO7 - Ethics and Sustainability:

Apply professional and ethical principles while considering safety, societal, environmental, and sustainability responsibilities in engineering practice.

PLO8 - Lifelong Learning:

Engage in independent and lifelong learning to adapt to emerging technologies and evolving professional needs.

PEOs and PLOs Matrix:

Program Learning Outcomes (PLOs)	**PEO1**	**PEO2**	**PEO3**	**PEO4**
PLO1 - Engineering Knowledge & Problem Solving	S	M	—	M
PLO2 - Engineering Design & Integration	S	S	M	M
PLO3 - Experimentation & Engineering Tools	S	S	M	M
PLO4 - Automation & Intelligent Systems	S	S	M	S
PLO5 - Research, Innovation & Entrepreneurship	M	S	S	S
PLO6 - Communication, Teamwork & Career Skills	S	M	S	M
PLO7 - Ethics & Sustainability	M	M	S	—
PLO8 - Lifelong Learning	M	M	M	S

S = Strong relationship | **M** = Moderate relationship | — = No significant direct relationship

6- Graduation Requirements – دەرچوونپێداویستیەکانی

In order to graduate with the Bachelor of Science in Mechatronic and Robotic Engineering degree, students are required to obtain a minimum of 240 ECTS and have a minimum cumulative grade point average (GPA) of 2.00/4.00 or a Normal Average Grade of 50.00/100

National Requirements:

No.	Modules	ECTS	Program
1	Kordology	4	MRED

2	General English	4	MRED

University requirements:

No.	Modules	ECTS	Program
3	Engineering Ethics	3	MRED
4	Academic Debate	4	MRED
5	Critical Reading and Writing	4	MRED
6	Engineering drawing and descriptive geometry	6	MRED
7	Career Skills	4	MRED
8	Entrepreneurship	4	MRED

Faculty requirements:

No.	Modules	ECTS	Program
9	Calculus	6	MRED
10	Engineering Mathematics	6	MRED
11	Partial Differential Equation (PDE)	6	MRED
12	Statics and Strength of Materials	6	MRED

Electronic Modules

No.	Modules	ECTS	Program
13	Electrical Circuits	6	MRED
14	Digital Logic Circuit	6	MRED
15	Electronics	6	MRED
16	Communication Systems	6	MRED

Electrical/Control & Automation Modules

No.	Modules	ECTS	Program
17	Control Systems	6	MRED
18	Motion Control System	6	MRED
19	Industrial Automation (PLC)	6	MRED
20	Electrical Machines and Drives	6	MRED
21	Industrial Control and Communication Systems	6	MRED

Computer/Programming Modules

No.	Modules	ECTS	Program

22	Programming Fundamentals (C, C++, Python)	7	MRED
23	Object-oriented programming	6	MRED
24	Advanced Programming (Python)	6	MRED

AI & Vision Modules

No.	Modules	ECTS	Program
25	Image Processing	6	MRED
26	Artificial Intelligence (AI)	6	MRED
27	Computer Vision	6	MRED
28	Machine Learning	6	MRED

Mechanic Modules

No.	Modules	ECTS	Program
29	Engineering Mechanics - Dynamics	6	MRED
30	Heat Transfer and Thermodynamics	6	MRED
31	Fluid Mechanics and Hydraulic Machines	6	MRED
32	Material Science	6	MRED
33	Industrial Design	6	MRED
34	Theory of Machines	6	MRED

Core Mechatronic and Professional Modules

No.	Modules	ECTS	Program
35	Introduction to Mechatronics and Robotics	6	MRED
36	Embedded Systems	6	MRED
37	CAD/CAM Technologies	6	MRED
38	Mechatronic System Design	6	MRED
39	Digital Manufacturing & Prototyping	3	MRED
40	Microcontroller	6	MRED

Core Robotics Modules

No.	Modules	ECTS	Program
41	Robotics Operating System (ROS)	5	MRED
42	Aerial Robotics Control	6	MRED

Capstone / Multidisciplinary

No.	Modules	ECTS	Program
43	Research and Capstone Project	6	MRED

7- Curriculum Requirements - داواکارییەکانی پڕۆگرامی خوێندن

1. General Education and University Requirements (33 ECTS)

The general education and university requirement component consists of eight modules totaling 33 ECTS. Students are required to complete the modules illustrated below:

1. Kurdology
2. General English
3. Critical Reading and Writing
4. Academic Debate
5. Engineering drawing and descriptive geometry
6. Engineering Ethics
7. Career Skills
8. Entrepreneurship

2. **Mathematics and Basic Sciences (24 ECTS):**

Mathematics and basic science courses must be taken for a minimum of **24 ECTS**. These courses must include at least 18 ECTS in mathematics, beginning with the first calculus course, along with 6 ECTS in Statics and Strength of Materials.

1. Calculus
2. Engineering Mathematics
3. Partial Differential Equations
4. Statics and Strength of Materials

Other Mechatronics and Robotics curriculum totals 184 ECTS according to the supplied final curriculum. Together with 33 ECTS of general education/university requirements and 24 ECTS of mathematics/basic sciences, the listed module credits sum to 241 ECTS. The final curriculum workbook also states a 240 ECTS program requirement; this one-credit discrepancy should be resolved in the formally approved curriculum record.

3. **Electrical and Electronic Engineering (24 ECTS):**

   The Electronics Modules cover the fundamentals of electrical circuits, digital logic, electronic devices, and communication systems.

1. Electrical Circuits
2. Digital Logic Circuit
3. Electronics
4. Communication Systems

4. **Electrical / Control & Automation (30 ECTS)**
   Electrical / Control & Automation modules include control systems, motion control, industrial automation using PLCs, electrical machines and drives, and integrated industrial control and communication systems.

4.1. Control Systems

4.2. Motion Control System

4.3. Industrial Automation (PLC)

4.4. Electrical Machines and Drives

4.5. Industrial Control and Communication Systems

4.6.

5. **Computer/Programming (19 ECTS)**

   Computer / Programming Modules include Programming Fundamentals (C, C++, Python) (7 ECTS), Object-oriented Programming (6 ECTS), and Advanced Programming (Python) (6 ECTS), totaling 19 ECTS.

5.1. Programming Fundamentals (C, C++, Python)

5.2. Object-oriented programming

5.3. Advanced Programming (Python)

6. **AI & Vision Modules (24 ECTS)**
   AI & Vision Modules introduce image processing, artificial intelligence, computer vision, and machine learning for intelligent robotic applications.

6.1. Image Processing

6.2. Artificial Intelligence (AI)

6.3. Computer Vision

6.4. Machine Learning

7. **Mechanical Engineering (30 ECTS)**
   Mechanical Engineering modules cover engineering mechanics and dynamics, heat transfer and thermodynamics, fluid mechanics and hydraulic machines, material science, and industrial design.

7.1. Engineering Mechanics - Dynamics

7.2. Heat Transfer and Thermodynamics

7.3. Fluid Mechanics and Hydraulic Machines

7.4. Material Science

7.5. Industrial Design

7.6.

8. Mechatronic Core (33 ECTS)
   These modules integrate mechanical, electrical, embedded-computing, design, and manufacturing competencies in the final curriculum.

8.1. Introduction to Mechatronics and Robotics

8.2. Embedded Systems

8.3. CAD/CAM Technologies

8.4. Mechatronic System Design

8.5. Digital Manufacturing & Prototyping

8.6. Microcontroller

9. **Robotics Core (12 ECTS)**
   The robotics core consists of Robotics Operating System (ROS) and Aerial Robotics Control.

9.1. Robotics Operating System (ROS)

9.2. Aerial Robotics Control

9.3.

10. **Capstone / Multidisciplinary (6 ECTS)**

    The Research and Capstone Project is the culminating supervised project in which students integrate knowledge and skills from across the program.

10.1. Research and Capstone Project

11. Elective Module (6 ECTS)

The supplied final curriculum identifies Theory of Machines as a 6 ECTS elective learning activity in Semester Seven.

1. Theory of Machines
2.
3.
4.
5.
6.
7.

8- Program Curriculum Synopsis (Module Content) - پێکهاتەی هەر مۆدیۆلێکی پرۆگرامی خوێندن

Course code: SOU20403
Course Name: Kordology
ECTS Number: 4

Pre-requisite:

Kurdology is the study of Kurds and Kurdistan, the history of language, literature in general, and the geography of Kurdistan. It covers the history of the Kurds and their religion.

The course primarily involves theoretical work over one semester. Overall, this course covers the history of the Kurds, the geography of Kurdistan, and Kurdish culture, including life, language, literature, poetry, and religion. By the end of the course, students will deepen their knowledge and become familiar with the history, geography, political changes, and social life of various aspects of their nation as Kurds. Introducing Kurdish nationality is the main point in this course, and representing the Kurds as a nation that has every element by which a nation can be described, this motivates the students to perfectly feel their real nationality and think about their future, and also the future of Kurdistan.

Course code: SOU20402
Course Name: General English
ECTS Number: 4
Pre-requisite:

Parts of speech (nouns, pronouns, verbs, adverbs, prepositions, conjunctions, interjections); kinds of sentences (simple, compound, complex); subordinate clauses; change of sentences from simple to compound and vice versa; tenses; passive and active; direct and indirect speech.

Course code: SOU20406
Course Name: Engineering Ethics
ECTS Number: 3
Pre-requisite:

Engineering Ethics examines the principles and standards that guide ethical decision-making in the engineering profession. The course introduces moral philosophies, professional codes of conduct, and the social, environmental, and legal responsibilities of engineers. Key topics include engineering professionalism, safety and risk assessment, sustainability, intellectual property rights, whistleblowing, and real-world case studies of engineering successes and failures. Students develop critical thinking and ethical reasoning skills to evaluate complex situations, make responsible decisions, and understand the broader societal, environmental, and economic impacts of engineering practice.

Course code: SOU20412
Course Name: Academic debate
ECTS Number: 4
Pre-requisite:

This intensive course focuses on improving students' communicative and academic study skills. The module is designed to first year university students as a systematic study of critical thinking skills. It is crucial for students to enhance their own reasoning skills as they progress to higher levels of academic study. It aims to raise students' awareness of how debates are constructed in written and spoken language. Furthermore, this course will provide general information on scientific debate and is linked to key citations and forms.

Course code: SOU20411
Course Name: Critical Reading and Writing
ECTS Number: 4
Pre-requisite:

This course will help First-Year Engineering students build essential English vocabulary, communication skills, and grammatical structures to engage in conversations and understand English effectively. Additionally, participants will develop writing and listening skills that enable them to apply them across different areas of life. The students will rely on additional resources to enhance engagement. The main

focus will be on the learner's four skills: Listening, Speaking, Reading, and Writing: Skimming for main ideas and scan for details/key words, Developing reading speed, building academic vocabulary, Summarizing and paraphrase information in a text, Separate facts from opinions, Writing a paragraph with a topic sentence, support, and concluding sentence, Understanding coherence and cohesion and using them in their writing.

Course code: SOU20412
Course Name: Career Skills
ECTS Number: 4
Pre-requisite:
The updated curriculum spreadsheet identifies Career Skills as a 4 ECTS module. A detailed module-content synopsis was not included in the supplied curriculum file and should be inserted from the approved module specification when available.

Course code: SOU20404
Course Name: Engineering drawing and descriptive geometry
ECTS Number: 6
Pre-requisite:

Engineering Drawing: Introduction, instruments & their use; applied geometry; dimensions & lettering; orthographic drawing & sketching; pictorial drawing & sketching auxiliary view; section; convection &assembly; projection in general. Descriptive Geometry: Representation of points, lines, and planes; types of planes; application of lines and planes; development of surfaces; determination of true lengths of straight lines by revolution and auxiliary planes; traces of planes; finding the line of intersection of planes by traces and projections.

Course code: SOU20401
Course Name: Calculus
ECTS Number: 6
Pre-requisite

Types of functions (trigonometric; inverse trigonometric functions, logarithmic functions, exponential functions, transcendental functions, other types of functions, graph of functions); Differentiation (explicit and implicit; application of derivatives in graphing); Integrals (integrals as a summation of areas; definite integrals, applications of definite integrals, areas and volumes; techniques of integration); determinants and matrices, conical section; Introduction to polar coordinates.

Course code: SOU20410
Course Name: Engineering Mathematics
ECTS Number: 6
Pre-requisite: Calculus

This is an elementary-level mathematics course in continuity with the calculus course. In this course, students get acquainted with some basic but useful subjects like vectors and matrices, and after that, they go through a little bit more sophisticated subjects like the application of derivatives and integrals, which are essential for all engineering students.

Course code: SOU20431
Course Name: Partial Differential Equation

ECTS Number: 6
Pre-requisite: Calculus

The use of mathematical methods in a form suitable for the solution of engineering problems. The engineers must know how to model problems in mathematical terms and solve and analyze them, providing an introduction to the basic properties of PDEs and the basic analytical techniques for solving them.

Course code: SOU20413
Course Name: Statics and Strength of Materials
ECTS Number: 6
Pre-requisite: Calculus

Familiarities of students with the conceptualize Statics and Strength of materials fundamental, preparing students for their special modules (e.g. students need to learn concepts of Engineering Mechanics), Linking theoretical concepts to their practical parts that are related to industry (e.g. moment of inertia and analyzing of plane trusses), Developing collaborative skills to illustrate students how to work as a group, how to negotiate, compromise and tolerance in a group.

Course code: SOU20414
Course Name: Electrical Circuits
ECTS Number: 6
Pre-requisite: Calculus

This course provides a comprehensive introduction to the principles and analysis of electrical circuits, which serve as the foundation for all areas of electrical, electronic, and mechatronic engineering. It covers fundamental laws such as Ohm's and Kirchhoff's laws, circuit-analysis techniques, including nodal, mesh, and superposition methods, and equivalent-circuit theorems such as Thevenin's and Norton's. Both DC and AC circuit behavior are studied, with emphasis on transient and steady-state responses of RLC circuits. The course also introduces frequency response, resonance, and power analysis in single- and three-phase systems. Through problem-solving, simulation tools, and laboratory experiments, students gain practical skills and a solid understanding of how electrical circuits are applied in real-world systems, preparing them for advanced topics in electronics, control, and robotics.

Course code: SOU20434
Course Name: Electronics
ECTS Number: 6
Pre-requisite: Electrical Circuit

This course provides a comprehensive study of the principles and applications of modern electronic devices and circuits. It begins with the analysis of RLC circuits, which must be taught in electrical circuits and semiconductor fundamentals, followed by the operation and characteristics of diodes, bipolar junction transistors (BJTs), MOSFETs, and advanced FinFETs (not in an undergraduate Electronics course for Mechatronics & Robotics). The course also covers amplifier design using operational amplifiers, switching circuits, and the role of electronics in signal conditioning, power conversion, and control systems. Emphasis

is placed on circuit analysis, modeling, and simulation, as well as practical skills in circuit design, prototyping, and testing through laboratory experiments. By the end of the course, students will be able to design and evaluate analog and digital electronic circuits, preparing them for advanced applications in robotics, automation, and embedded systems.

Course code: SOU20442
Course Name: Digital Logic Circuit
ECTS Number: 6
Pre-requisite: Electrical Circuit

This course provides a detailed introduction to the principles and applications of digital electronics, forming the foundation for computer engineering, embedded systems, and robotics. It covers number systems, codes, Boolean algebra, and the design and analysis of logic gates and combinational circuits, as well as minimization techniques using Karnaugh maps and Boolean simplification. Sequential logic design is explored using flip-flops, counters, shift registers, memory elements, and finite-state machines. The course also introduces programmable logic devices (PLDs), field-programmable gate arrays (FPGAs), and basic hardware description languages (HDLs), such as Verilog. Practical laboratory work emphasizes circuit design, simulation, and implementation, enabling students to bridge theoretical knowledge with real-world digital hardware applications. By the end of the course, students will be able to design, test, and analyze digital logic systems used in microcontrollers, computer systems, and robotic platforms.

Course code: SOU20441
Course Name: Microcontrollers
ECTS Number: 6
Pre-requisite: Digital Logic and Electronics

This module provides students with a solid introduction to microcontroller systems, focusing on the AVR family (e.g., ATmega series) and programming in the BASCOM-AVR language. Students will explore the internal architecture of AVR devices, instruction sets, memory organization, and input/output handling.
Practical sessions will emphasize programming techniques in BASCOM to control digital and analog signals, use timers and interrupts, and establish communication. Learners will also gain experience in interfacing microcontrollers with sensors, actuators, and motors.
A key application of the module is in the development of autonomous car robots. Students will design and program AVR-based systems in BASCOM to manage motor control, detect obstacles, and navigate. By the end of the module, they will be able to integrate both hardware and software to build functional embedded systems and apply them in real-world robotics projects.

Course code: SOU20433
Course Name: Communication Systems
ECTS Number: 6
Pre-requisite: Electronic and Electrical Circuit

This module introduces the fundamental principles and techniques used in modern communication systems. It covers both analog and digital communication methods, including modulation and

demodulation, signal transmission, noise analysis, bandwidth considerations, and multiplexing techniques. The course explores real-world applications of radio, television, satellite, and mobile communications. Students will gain both theoretical knowledge and practical skills through simulations and lab work on transmitters, receivers, and signal processing.

Course code: SOU20452
Course Name: Control Systems
ECTS Number: 6
Pre-requisite: Calculus, PDE, Electrical circuits

This course introduces the fundamental principles and methods of feedback control systems used in mechatronic and industrial applications. Topics include mathematical modeling of dynamic systems, time-domain and frequency-domain analysis, stability criteria, and the design of classical controllers such as PID, lead–lag, and state-space controllers. Emphasis is placed on the application of control theory to electrical, mechanical, and electromechanical systems, including motors, actuators, and industrial processes. Laboratory sessions provide hands-on experience with simulation and implementation of control algorithms using modern software tools and real-time hardware, enabling students to analyze system performance and design effective control solutions for automation, robotics, and smart manufacturing systems.

Course code: SOU20460
Course Name: Motion Control System
ECTS Number: 6
Pre-requisite: Control Systems, Embedded Systems

This module provides a comprehensive study of motion control principles, technologies, and applications. It introduces the dynamics and modeling of motion systems, with a focus on actuators, sensors, and control architectures used in precision positioning and velocity regulation. Students will learn trajectory planning, feedback control strategies, and digital implementation techniques. Advanced topics include multi-axis coordination, adaptive and predictive control, and real-world industrial applications, including robotics, CNC machines, and automation systems. By the end of the module, learners will be able to analyze, design, and implement motion control solutions for modern mechatronic and industrial environments.

Course code: SOU20462
Course Name: Industrial Automation (PLC)
ECTS Number: 6
Pre-requisite: Digital Logic, Electrical Circuit

This course introduces the principles and applications of industrial automation with a focus on Programmable Logic Controllers (PLCs). Students will learn the fundamentals of automation systems, PLC architecture, programming languages, sensors and actuators, input/output modules, and communication networks used in modern industry (in another course). The course emphasizes practical skills in designing, programming, and troubleshooting PLC-based control systems for manufacturing and process automation, while also addressing safety standards and industrial protocols. By the end of the course, students will be able to develop, implement, and evaluate PLC programs for automated systems, integrate hardware and software components, and apply automation solutions to real-world industrial scenarios. Teaching methods include lectures, laboratory exercises, and project work, with assessment based on assignments, lab

performance, exams, and a final project.

Course code: SOU20464
Course Name: Embedded Systems
ECTS Number: 6
Pre-requisite: Microcontrollers

This course introduces the fundamental concepts, architectures, and design principles of embedded systems. Students will learn how hardware (microcontrollers, sensors, and actuators) and software (Arduino IDE, Pi Operating Systems) work together to create intelligent systems. Practical applications such as robotics, IoT devices, and automation systems will be emphasized to strengthen the link between theory and practice.

Course code: SOU20407
Course Name: Programming Fundamentals (C, C++, Python)
ECTS Number: 7
Pre-requisite:

This course introduces essential programming concepts and computational problem-solving using C, C++, and Python. Core topics include data types, variables, operators, control structures, functions, arrays, pointers, and basic object-oriented principles. Emphasis is placed on structured programming in C, with extensions to C++ for object-oriented design, and on Python for rapid prototyping and scripting in engineering applications. Through hands-on exercises and projects, students develop the ability to write efficient, well-structured code and apply programming skills to solve problems in robotics, automation, and mechatronic systems.

Course code: SOU20430
Course Name: Object-oriented programming
ECTS Number: 6
Pre-requisite: Programming Fundamentals (C, C++, Python)

This module introduces the principles of object-oriented programming (OOP) and their application in problem-solving and software development. It covers the concepts of classes, objects, encapsulation, inheritance, polymorphism, and abstraction. Students will gain practical skills in designing, developing, testing, and debugging object-oriented programs using a high-level programming language.

Course code: SOU20440
Course Name: Advanced Programming (Python)
ECTS Number: 6
Pre-requisite: Programming Fundamentals (C, C++, Python)

This course builds on fundamental programming skills and explores advanced concepts in Python for engineering and robotics applications. Topics include object-oriented design, data structures, file handling, exception management, multithreading, and libraries for numerical computing, visualization, and automation. Students will also gain experience with Python modules for robotics and AI, developing efficient solutions to complex computational and control problems.

Course code: SOU20451
Course Name: Image Processing

ECTS Number: 6

Pre-requisite: Advanced programming, Digital logic

This course provides a comprehensive introduction to the fundamental principles and techniques of digital image processing, covering both theoretical foundations and practical applications. Students will explore image representation and formats; enhancement and restoration methods; color models; spatial- and frequency-domain filtering; edge detection; segmentation; feature extraction; morphological processing; and image compression, with applications in areas such as computer vision, medical imaging, and multimedia. By the end of the course, students will be able to understand the mathematical and computational foundations of image processing, implement algorithms using software tools such as MATLAB or Python, evaluate and compare methods, and develop problem-solving skills for real-world scenarios. Teaching methods include lectures, laboratory exercises, project work, and case studies, with assessment based on assignments, lab reports, exams, and a final project.

Course code: SOU20461

Course Name: Artificial Intelligence (AI)

ECTS Number: 6

Pre-requisite: Advanced programming

This course introduces the foundations of artificial intelligence with an emphasis on classical AI algorithms and their applications in robotic and mechatronic systems. Topics include intelligent agents, problem formulation, state-space search, path planning, reasoning, knowledge representation, rule-based systems, decision-making, and basic planning algorithms. The course focuses on how AI techniques are used to enable autonomy, perception, and decision-making in robots, such as navigation, task planning, obstacle avoidance, and system supervision. Practical activities involve implementing AI algorithms and integrating them with sensors, control systems, and robotic platforms, preparing students to design intelligent behaviors for autonomous and industrial robotic systems.

Course code: SOU20472

Course Name: Computer Vision

ECTS Number: 6

Pre-requisite: Advanced programming, AI

This course introduces the principles and methods of computer vision with a strong emphasis on the use of cameras and visual sensors in mechatronic and robotic systems. Topics include image formation and acquisition, fundamental image processing techniques, segmentation, feature detection and matching, motion analysis, and basic 3D vision concepts. The course focuses on how visual information is used for robot perception, inspection, navigation, object recognition, and tracking. Laboratory sessions provide extensive hands-on experience with camera calibration, image acquisition, and real-time vision applications using modern computer vision libraries and tools. Students also gain an introductory understanding of deep learning–based vision methods, with practical applications in object detection and visual tracking for robotics and industrial automation.

Course code: SOU20481

Course Name: Machine Learning

ECTS Number: 6
Pre-requisite: Advanced programming, AI

This course introduces students to the principles, techniques, and applications of machine learning (ML). It covers both supervised and unsupervised learning methods, with a balance between theory and hands-on practice using Python libraries. Students will learn to preprocess data, explore datasets, apply ML algorithms, evaluate models, and tune parameters for optimal performance.

Course code: SOU20484
Course Name: Industrial Design
ECTS Number: 6
Pre-requisite: Engineering drawing and descriptive geometry, CAD/CAM Technologies

The industrial design course introduces the principles and practices of industrial design with a focus on engineering products and systems. It explores the integration of aesthetics, ergonomics, functionality, and manufacturability in the design process. Students learn to translate user needs and technical requirements into innovative product concepts using sketches, CAD modeling, and rapid prototyping. Emphasis is placed on sustainability, material selection, and design for manufacturing and assembly. Through lectures, studio sessions, and project work, students develop creative problem-solving skills and the ability to design engineering products that are functional, efficient, and user-centered.

Course code: SOU20432
Course Name: Engineering Mechanics - Dynamics
ECTS Number: 6
Pre-requisite: Engineering Mathematics, Statics, and Strength of Materials

Engineering Mechanics – Dynamics focuses on the principles governing the motion of particles and rigid bodies under the action of forces. The module builds upon statics to analyze motion using kinematics (displacement, velocity, acceleration) and kinetics (force, mass, and acceleration; energy methods; impulse and momentum). Topics include rectilinear and curvilinear motion of particles, dynamics of systems of particles, planar kinematics of rigid bodies, work-energy and power methods, impulse-momentum applications, and an introduction to vibration and mechanical systems. Emphasis is placed on developing problem-solving skills and applying theoretical concepts to practical engineering situations, preparing students for advanced courses in machine dynamics, vibrations, and mechanical design.

Course code: SOU20444
Course Name: Heat Transfer and Thermodynamics
ECTS Number: 6
Pre-requisite: Engineering Mathematics, Statics, and Strength of Materials

Heat Transfer is a fundamental engineering course that introduces students to the mechanisms of thermal energy transport: conduction, convection, and radiation. It explores analytical and practical methods for quantifying heat transfer across mechanical, electrical, chemical, and robotic systems.
For Mechatronics and Robotics Engineering, understanding heat transfer is essential for designing thermal management systems in electronic components, actuators, sensors, and high-performance machinery. It also plays a crucial role in ensuring the safety, efficiency, and longevity of robotic systems and integrated smart devices.

Within the department's curriculum, this course provides critical theoretical and analytical skills that support advanced topics such as thermal control systems, materials processing, embedded systems, and energy conversion technologies. The knowledge gained in this course bridges the gap between theoretical science and engineering application, preparing students to address real-world thermal challenges in robotic and automated systems.

Course code: SOU20453
Course Name: Fluid Mechanics and Hydraulic Machines
ECTS Number: 6
Pre-requisite: Engineering Mathematics, Heat Transfer, and Thermodynamics

The Fluid Mechanics and Fluid Power course provides a comprehensive introduction to fluid mechanics and the basic principles of hydraulics and pneumatics, followed by coverage of various system components, tailored for Mechatronics and Robotics Engineering students. The course combines theoretical foundations with practical applications in automation and robotics. It equips students to analyze and understand the interrelationships between principles and components of hydraulic and pneumatic operating systems. The course supports the development of analytical and problem-solving skills necessary for professional engineering practice.

Course code: SOU20473
Course Name: Entrepreneurship
ECTS Number: 4
Pre-requisite:

Entrepreneurship is a 4 ECTS University Requirement module scheduled in Semester Seven in the supplied final curriculum. A detailed approved module-content synopsis was not included in the supplied final curriculum workbook; the official module specification should be inserted here when available.

Course code: SOU20471
Course Name: Material Science
ECTS Number: 6
Pre-requisite: Engineering Mathematics, Heat Transfer and Thermodynamics

The Material Science and Manufacturing course provides a comprehensive introduction to the science and engineering of materials, focusing on the structure, properties, processing, and performance of metals, polymers, ceramics, and composites used in mechanical components. Students will learn how atomic and microstructural characteristics influence mechanical, thermal, and environmental behavior. Emphasis is placed on the selection and treatment of materials for strength, durability, corrosion resistance, and manufacturability in mechanical and robotic systems.

Course code: SOU20475
Course Name: Theory of Machines
ECTS Number: 6
Pre-requisite: Statics and Strength of Materials, Material Science and Manufacturing, Heat Transfer, and Thermodynamics

The Machine course introduces the fundamental principles of machine kinematics and dynamics. It covers the analysis of mechanisms, motion, velocity, and acceleration of machine elements; cam and gear trains; flywheels; governors; balancing of rotating and reciprocating masses; and vibration of mechanical systems. Emphasis is placed on understanding how machine components move, transmit power, and respond to forces in order to design efficient and reliable mechanical systems. Through lectures, problem-solving exercises, and laboratory demonstrations, students develop the ability to model, analyze, and optimize mechanisms used in engines, turbines, manufacturing equipment, and other mechanical and robotic devices.

Course code: SOU20445
Course Name: Introduction to Mechatronics and Robotics
ECTS Number: 6
Pre-requisite:

This module introduces the interdisciplinary field of mechatronics and robotics, focusing on integrating mechanical, electrical, electronic, and computer engineering to design and develop intelligent systems. Students will explore the fundamentals of sensors, actuators, signal processing, microcontrollers, and control systems, and learn how these components interact within modern robotic and automated systems. Core topics include robotic mechanisms, kinematics, dynamics, programming, and system modeling. Emphasis is placed on practical applications, problem-solving, and system integration, enabling students to understand how theory translates into real-world solutions. Laboratory sessions and design-based projects provide hands-on experience in building and controlling mechatronic and robotic systems, fostering both technical competence and innovation.

Course code: SOU20450
Course Name: Electrical Machines and Drives
ECTS Number: 6
Pre-requisite: Electrical Circuit

Electrical Machines and Drives is a comprehensive module that focuses on the conversion of electrical energy into mechanical energy and vice versa. It covers the construction, operating principles, modeling, and performance of transformers, DC machines, and AC machines, such as induction and synchronous motors. The course introduces power electronic converters, motor control strategies, and drive systems used in modern industry. Emphasis is placed on efficiency, losses, speed control, and real-world applications in industrial automation, transportation, and renewable energy systems.

Course code: SOU20454
Course Name: CAD/CAM Technologies
ECTS Number: 6
Pre-requisite: Engineering drawing and descriptive geometry

CAD/CAM Technologies focuses on the principles and applications of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) in modern engineering and manufacturing processes. The module covers digital design methods, 3D modeling, product visualization, process planning, and the integration of CAD with CAM systems for automated production. It emphasizes the use of advanced software tools, CNC

programming, and simulation techniques to improve product quality, efficiency, and innovation in manufacturing industries.

Course code: SOU20470
Course Name: Robotics Operating System (ROS)
ECTS Number: 6
Pre-requisite: Embedded systems

This course provides a comprehensive introduction to the Robotics Operating System (ROS), an open-source middleware widely used in robotics research and industry. Students will learn the ROS architecture, including nodes, topics, services, messages, and launch files, as well as tools for debugging, visualization, and simulation, such as RViz and Gazebo. The course covers the integration of sensors, actuators, and robotic hardware, with practical deployment on embedded platforms such as the Raspberry Pi for real-world experimentation. Advanced topics include mobile robot control, navigation, mapping, and multi-robot communication. Through hands-on projects, students develop the skills to design, implement, and test modular, scalable, and autonomous robotic applications.

Course code: SOU20463
Course Name: Mechatronic System Design
ECTS Number: 6
Pre-requisite: Embedded systems and Microcontrollers

Mechatronic System Design introduces the integration of mechanical, electrical, electronic, and computer engineering principles for designing and developing intelligent systems and products. The course emphasizes system-level thinking, modeling, and simulation of mechatronic components, including sensors, actuators, control systems, and embedded processors. Students will learn methodologies for designing, prototyping, and testing mechatronic systems, with applications ranging from robotics and automation to automotive and consumer products.

Course code: SOU20474
Course Name: Digital Manufacturing & Prototyping
ECTS Number: 3
Pre-requisite: CAD/CAM Technologies

Digital Manufacturing & Prototyping focuses on modern techniques for designing, simulating, and producing products using digital tools. The module covers CAD/CAM systems, rapid prototyping, additive manufacturing, and CNC technologies. It emphasizes integrating digital design with manufacturing processes to drive innovation, improve efficiency, and accelerate product development. Hands-on sessions emphasize the use of CAD tools, slicing software, and 3D printers to prototype and test functional robotic devices.

Course code: SOU20482
Course Name: Aerial Robotics Control
ECTS Number: 6
Pre-requisite: Embedded systems

This course introduces the fundamentals of aerial robotic systems, with a focus on the design, dynamics, control, and navigation of unmanned aerial vehicles (UAVs). Topics include quadrotor kinematics, propulsion systems, flight control algorithms, localization, mapping, and path planning. Students will also explore applications of aerial robots in fields such as inspection, surveillance, and delivery. Practical labs and projects using simulation tools and platforms, such as drones or Raspberry Pi-based UAVs, provide hands-on experience in programming, control, and autonomous flight.

Course code: SOU20485
Course Name: Industrial Control and Communication Systems
ECTS Number: 6
Pre-requisite: Control Systems, PLC

This module integrates industrial communication and supervisory control. It covers industrial network architectures and protocols such as Modbus, CAN/CANopen, PROFIBUS, PROFINET and Industrial Ethernet, together with SCADA architecture, HMI design, data acquisition, alarms, trending, operator interaction, and PLC-based system integration. Laboratory work emphasizes wiring, configuration, diagnostics, HMI/SCADA implementation, and reliable data exchange among sensors, actuators, drives, PLCs, and supervisory systems.

Course code: SOU20486
Course Name: Research and Capstone Project
ECTS Number: 6
Pre-requisite:

The Research and Capstone Project module is the culminating experience of the Mechatronics and Robotics program. It provides students with the opportunity to apply theoretical knowledge and practical skills from prior coursework to a comprehensive, real-world engineering problem. Students are expected to identify a problem, conduct research, design and implement a mechatronic or robotic system, and rigorously test and evaluate their solution. The project emphasizes interdisciplinary collaboration, system integration, innovation, problem-solving, and project management. Deliverables include a functional prototype,

technical documentation, and a formal presentation or demonstration. This module prepares students for professional practice, research, or further academic study in mechatronics, robotics, and automation.

9- Credits, Grading and GPA - یەکەکان، شێوازی هەڵسەنگاندن، نمرەی دەرچوون

ECTS, GRADING, AND GPA	
CREDITS	Soran University follows the Bologna Process and uses the European Credit Transfer System (ECTS). 1 ECTS is equivalent to 27 hours of student workloads, including both structured and unstructured workloads.
GRADING	Before the evaluation, the results are divided into two subgroups: pass and fail. Therefore, the results are independent of the students who failed a course. The grading system is defined as follows:
GPA, CALCULATING	A: 90 - 100 B: 80 – less than 90 C: 70 – less than 80 D: 60 – less than 70 E: 50 – less than 60F: less than 50 Calculation of the Grade Point Average (GPA) ▪ Each alphabetical grade is substituted by numerical equivalent: A=5.0, B=4.0, C=3.0, D=2.0 and E=1 ▪ The numerical equivalent is multiplied by the number of credits for thecourse ▪ The products of the course and credits are totaled ▪ The sum is divided by the total number of credits ▪ The quotient is calculated to three decimal points ▪ GPAs are not rounded up

10- Program Curriculum Structure (Typical) - پێکهاتەی پڕۆگرامی خوێندن

Curriculum – BSc. in Mechatronic and Robotic Engineering Department

CL:	Class Lecture	**B:**	Basic learning activities
L:	Laboratory	**C:**	Core learning activity
P:	Practical Training	**S:**	Supported or related learning activity
T:	Tutorial	**E:**	Elective learning activity

Semester 1

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU20407	Programming Fundamentals (C, C++, Python)	2	3	0	2	7	B	MRED
2	SOU20406	Engineering Ethics	3			1	3	B	MRED
3	SOU20404	Engineering drawing and descriptive geometry		4			6	B	MRED
4	SOU20403	Kordology	4				4	B	MRED
5	SOU20402	General English	4				4	B	MRED
6	SOU20401	Calculus	3			1	6	S	MRED

Semester 2

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2041	Electrical Circuits	2	2	0.5	0.5	6	S	MRED
2	SOU2043	Object oriented programming	3			1	6	S	MRED
3	SOU2041	Academic Debate					4	B	MRED
4	SOU2041	Critical Reading and Writing	4				4	B	MRED
5	SOU2041	Career Skills	3			1	4	B	MRED
6	SOU2041	Engineering Mathematics					6	S	MRED

Semester 3

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2041	Statics and Strength of Materials	2	2			6	S	MRED
2	SOU20445	Introduction to Mechatronics and Robotics					6	C	MRED
3	SOU20432	Engineering Mechanics - Dynamics	3			1	6	S	MRED
4	SOU2044	Digital Logic Circuit	2	2	0.5	0.5	6	S	MRED
5	SOU2043	Electronics	2	2		0.5	6	C	MRED

Semester 4

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2044	Advanced Programming (Python)	2	2			6	S	MRED
2	SOU2044	Microcontroller	2	2	0.5	0.5	6	C	MRED
3	SOU2043	Communication Systems	2	2	0.5	0.5	6	S	MRED
4	SOU2043	Partial Differential Equation	2	1	1		6	C	MRED
5	SOU2044 4	Heat Transfer and Thermodynamics	3			1	6	S	MRED

Semester 5

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2045	Electrical Machines and Drives	2	2	0.5		6	C	MRED
2	SOU2045	Image Processing	3			1	6	C	MRED
3	SOU2045	Control Systems	2	2			6	C	MRED
4	SOU2045 3	Fluid Mechanics and Hydraulic Machines	3	3			6	C	MRED
5	SOU2045	CAD/CAM Technologies	1	3	0.5		6	S	MRED

Semester 6

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU20460	Motion Control System	2	2	0.5	0.5	6	C	MRED
2	SOU20461	Artificial Intelligence (AI)	4	2			6	C	MRED
3	SOU20462	Industrial Automation (PLC)	2	3			6	C	MRED
4	SOU20463	Mechatronic System Design	2	2	0.5	0.5	6	C	MRED
5	SOU20464	Embedded Systems	3			1	6	C	MRED

Semester 7

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU20470	Robotics Operating System	2	2	0.5	0.5	6	C	MRED
2	SOU20471	Material Science	1		2		6	C	MRED
3	SOU20472	Computer Vision	2	2			6	C	MRED
4	SOU20473	Entrepreneurship	3			1	4	C	MRED
5	SOU20474	Digital Manufacturing & Prototyping	0.5	1.5	0.5	1	3	C	MRED
6	SOU20475	Theory of Machines					6	E	MRED

Semester 8

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2048	Machine Learning	2	2			6	C	MRED
2	SOU2048	Aerial Robotics Control	2	2	0.5		6	C	MRED

3	SOU2048	Industrial Design	4	2			6	C	MRED
4	SOU2048 5	Industrial Control and Communication Systems					6		MRED
5	SOU2048	Research and Capstone Project	0	4			6	C	MRED

Elective Modules

No.	Code	Suggested Modules	CL	L	P	T	ECTS	Type	Notes
1	SOU2047	Theory of Machines					6	E	MRED

11- Academic Staff

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