Subject programme

1. Subject name / subject module: **Data Transmission**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Engineering and Mechatronics**
   - Degree of the studies: **1st degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Buler Piotr, mgr**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Mode of study																					Total
	...	SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				22	28	2																2
Part-time studies																						
Credit rigor			Graded assignment																			

6. Student workload – ECTS credits balance

   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	Hourly student workload (full-time studies/part-time studies)
Participation in lectures	-
Participation in laboratory classes	22
Preparation for laboratory classes	16
Independent study of the subject	10
Participation in an exam / graded assignment	2
Total student workload (TSW)	50
ECTS credits	2
* Student's workload related to trainings	50
Student's workload in classes requiring direct participation of academic teachers	22

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Outcome symbol	Outcome description	Form	Teaching method	Methods for testing of (checking, assessing) learning outcomes
Specific learning outcomes for the subject				
Knowledge				
K_W04	A student has adequate knowledge in the field of technical informatics and telecommunications, necessary to understand principles of data transmission and to apply this knowledge in practice through the use of appropriate methods, tools, and technologies	Laboratory work	Inquiry methods	Student learning activities
K_W06	A student possesses sufficient knowledge about interfaces for transmitting data in computer and control systems.			
Skills				
K_U03	Student has experience related to the maintenance of communication devices and data interfaces typical for the mechatronics industry	Laboratory work	Inquiry methods	Student learning activities
Social competence				

9. Assessment rules / criteria for each form of education and individual grades

0% - 50%	ndst	80% - 86%	db
51% - 70%	dst	97% - 93%	db+
71% - 79%	dst+	94% - 100%	bdb

Activity	Grades	Calculation	To Final
Lab reports	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,4,5,4) * 100%	4,0
Final result			4,0
Grade		4,0/5 = 80%	**db (4,0)**

10. The learning contents with the form of the class activities on which they are carried out (Laboratory work)

1. Parallel data transmission via PCI;

2. Serial USB data transmission;

3. Data transmission through the I2C coupling;

4. JTAG interface and TAP controller;

5. RFID radio frequency identification;

6. PowerLink transmission;

7. The use of an Internet network for communication with measurement and control systems;

8. Read and write data to magnetic and electronic cards;

9. Ways to protect data transmission from interference;

10. Identify the ModBus communication protocol in the RTU transmission mode that uses RS485 as the physical layer. ;

11. Fiber-optic transmission;

12. Infrared data transmission.

11. Required teaching aids

a. Lecture - multimedia projector.

b. Laboratory classes - specialist laboratory.

c. Exercises - a room adapted for conducting classes in the form of exercises / workshops, multimedia projector.

12. Literature:

a. Basic literature:

1. Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier; Introduction to Embedded Systems; ISBN 978-1-4614-3143-5; Springer, New York, NY 2014

a. Number Systems and Data Formats - pages 31-80

b. Fundamentals of Interfacing - pages 249-297

c. Principles of Serial Communication - pages 475-536

2. Frenzel, Louis E.; Handbook of Serial Communications Interfaces: A Comprehensive Compendium of Serial Digital Input/Output (I/O) Standards; ISBN 978-0-12-800629-0; Elsevier 2016

   b.   Supplementary literature:

      1. Warren Gay; Custom Raspberry Pi Interfaces; ISBN 978-1-4842-2406-9; Apress, Berkeley, CA 2017

      2. Jens-Rainer Ohm; Multimedia Signal Coding and Transmission; ISBN 978-3-662-46691-9; Springer, Berlin, Heidelberg 2015

   c.   Internet sources:

      1. Sparkfun Learning Tutorials - learn.sparkfun.com

      2. Industrial Wireless Guide - www.newark.com/wcsstore/ExtendedSitesCatalogAssetStore/cms/asset/pdf/americas/common/storefront/advantech/industrial-wireless-guide.pdf

      3. Industrial Ethernet Tutorial - www.automationworld.com/products/networks/news/13313765/industrial-ethernet-tutorial

      4. Powerlink - https://www.ethernet-powerlink.org/powerlink/technology

      5. Full guide to serial communication protocol - www.maximintegrated.com/en/design/technical-documents/app-notes/3/3884.html

      6. Guide to selecting and using RS-232, RS-422 and RS-485 - www.maximintegrated.com/en/design/technical-documents/tutorials/7/723.html

      7. Modbus communication protocol - www.chauvin-arnoux-energy.com/sites/default/files/D00VFQ98.PDF

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Buler Piotr, mgr
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	