COURSE OUTLINE

1. Data about the study programme

1.1 Higher education institution	Transilvania University of Brasov
1.2 Faculty	Mathematics and computer science
1.3 Department	Mathematics and computer science
1.4 Field of study[1)]	Computer science
1.5 Study level[2)]	MA
1.6 Study programme/ Qualification	Internet Technologies / Computer science

2. Data about the course

2.1 Name of course				**BAZELE TEHNOLOGIILOR INTERNET / INTERNET TECHNOLOGIES BASES**				
2.2 Course convenor				**VASILESCU Anca, DEMETER Robert**				
2.3 Seminar/ laboratory/ project convenor				**VASILESCU Anca, DEMETER Robert**				
2.4 Study year	1	2.5 Semester	1	2.6 Evaluation type	E	2.7 Course status	Content[3)]	PC
							Attendance type[4)]	CPC

3. Total estimated time (hours of teaching activities per semester)

3.1 Number of hours per week	**4**	out of which: 3.2 lecture	**2**	3.3 seminar/ laboratory/ project	**0/2/0**
3.4 Total number of hours in the curriculum	56	out of which: 3.5 lecture	28	3.6 seminar/ laboratory/ project	0/28/0
Time allocation					hours
Study of textbooks, course support, bibliography and notes					42
Additional documentation in libraries, specialised electronic platforms, and field research					42
Preparation of seminars/ laboratories/ projects, homework, papers, portfolios, and essays					42
Tutorial					10
Examinations					8
Other activities.....					

3.7 Total number of hours of student activity	144
3.8 Total number per semester	200
3.9 Number of credits[5)]	8

4. Prerequisites (if applicable)

4.1 curriculum-related	• Bases in computer network communication • Computer programming for distributed systems • Notions of academic writing and scientific and professional ethics
4.2 competencies-related	• General and specific competencies following the graduated bachelor study program • Research competencies at the bachelor level

5. Conditions (if applicable)

5.1 for course development	• Overhead projector, hand-outs, laptop/notebook
5.2 for seminar/ laboratory/ project development	• Laboratory class with educational and ICT resources: a computer network, network interconnection equipment, internet services, online laboratory guide, IoT-specific hardware components (breadboards, LEDs, connectors, sensors, actuators, etc.)

6. Specific competencies

Professional competencies	PC1. Specification, design and development of software systems using methodologies and development platforms LO1.2. The graduate is able to recognise a problem in a studied theoretical framework. LO1.4. The graduate is able to provide proofs, demonstrations, and explanations regarding the validity of the stated IT results. PC2. Analysing network configuration and performance, using specific interfaces of applications, and managing system security. LO2.2. The graduate understands and uses specific application interfaces and use cases.

Professional competencies	PC3. Deepening the latest methodologies and technologies used in the software industry LO3.3. The graduate is able to make interconnections between different computer fields. LO3.4. The graduate is able to produce synthesis materials on a theoretical or applied subject. LO3.6. The graduate is able to apply modern computer science methods and techniques to solving a wide range of problems. PC4. Establish data processes, administer data collection systems, develop data processing applications, and perform data mining. LO4.3 The graduate creates customised data processing software by selecting and using the appropriate programming language such that an ICT system produces required outputs based on expected inputs.
Transversal competencies	TC1. Communication and cooperation in professional contexts LO1.3. The graduate is able to cooperate with and integrate into professional and interdisciplinary teams to work in the educational field. LO1.5. The graduate is able to give public presentations and communications to promote knowledge and professional values. TC2. Career development and management LO2.1. The graduate documents themself and identifies opportunities for continuing professional training. LO2.6. The graduate accomplishes the professional duties with responsibility, respecting professional ethics and deontology.

7. Course objectives (resulting from the specific competencies to be acquired)

7.1 General course objective	This module presents specific topics about Internet technologies, considering the hardware and software support for LAN, WAN and Internet of Things approaches. After this module, the master student will be able to understand the computer network and implicitly the internet at a basic level based on interconnected components, communication protocols and specific algorithms.
7.2 Specific objectives	• knowing the main types of computer networks and interconnection equipment; • choosing and implementing appropriate algorithms for designing and deploying systems with Ethernet support; • deploying basic client-server communication applications; • prototyping and implementing basic Internet of Things architectures for modern smart domains by taking advantage of transforming everyday objects into smart devices with sensors and actuators

8. Content

8.1 Course	Teaching methods	Number of hours	Remarks
Internet working technologies. Fundamentals. OSI reference model. Data encapsulation. Host-to-host communication	problematising lecturing design and develop in teams group working conversation case studies	4	
TCP/IP addressing. Overview of TCP/IP. IP protocols. IP addresses. Sub-netting. NAT and PAT. Routing protocols. Practice		4	
Internet protocol IPv6. Introduction to IPv6. IPv6 Routing Protocols. Configuration of IPv6. Advantage of IPv6.		2	
Distributed application development. The network application architecture. Berkeley socket interface. Socket API functions. Client/server applications using TCP and UDP protocols		4	
IoT context. WoT & IoT. CPS & ADS & IoT. IoT & IoUT & IoE.		2	
IoT definitions. Overview. Applications. Opportunities and challenges. Architecture. Research IoT context		2	
Sensors and actuators. Sensor networks. Robotics. *Stigmergy* intelligent systems. Smart systems		2	
Interacting with the board – digital outputs, pulse width modulation pins, digital inputs, polling, interrupts, analog inputs, local storage		2	
Software platform support for developing IoT applications. Examples (Arduino IDE, Microsoft Azure, AWS, Blink, RemoteXY et al.)		2	
From the real world toward the autonomous systems. Using sensors and actuators for endowing the self-* properties. State of the art in IoT related to novel domains		4	

Bibliography

1. ***, sas – The power to know, *The Internet of Things: Understanding the Adventure*, online e-book (30 September 2022) https://www.sas.com/sas/offers/20/iot-understanding-adventure.html
2. James F. Kurose, Keith W. Ross: "*Computer Networking: A Top-Down Approach*", Pearson, 7th edition, 2016
3. ***, "*Internet of Things. Principles and Paradigms*", Edited by Rajkumar Buyya and Amir Vahid Dastjerdi, Elsevier, 2016
4. Gerard Jounghyun Kim, *Human-Computer Interaction, Fundamentals and Practice*, CRC Press, 2015, https://www.academia.edu/38973879/Human_Computer_Interaction_Fundamentals_and_Practice
5. Bahga, A., Madisetti, V., "*Internet of Things: A Hands-on Approach Simulation"*, Published by Arshdeep Bahga & Vijay Madisetti, 2014
6. Kai Hwang, Jack Dongarra, and Geoffrey C. Fox*, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"*, Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1st ed, 2011
7. Andrew S. Tanenbaum: "*Computer Networks*", Pearson, 5th edition, 2010

8.2 Seminar/ laboratory/ project	Teaching-learning methods	Number of hours	Remarks
Distributed networks monitoring and supervise	group working	2	
Configure Layer 2 switches. VLAN implementation in Layer 2 switches		2	
Configure IP addresses, subnet masks, and gateway addresses on routers and hosts	experiment in small groups	4	
Cisco routers configuration		2	
Distributed applications development using Berkeley sockets API		4	
Understanding and setting up the base IoT hardware		2	
Using the TinkerCAD Circuits Platform to editing and simulating IoT prototypes	exercises	4	
Interacting with the board. Arduino IDE support for developing IoT applications. Other software platform support (Microsoft Azure, Blynk, RemoteXY, et al.)	peer-review software development	4	
Developing IoT hardware-software projects. Onboard projects. State of the art study		4	

Bibliography

1. Andy King*, Programming the Internet of Things*, O'Reilly Media Inc., Sebastopol, CA 95472, 2021
2. Agus Kurniawa, *"Intelligent IoT Projects in 7 Days",* Packt Publishing Limited, September 2017
3. ***, "*Internet of Things. Principles and Paradigms*", Edited by Rajkumar Buyya and Amir Vahid Dastjerdi, Elsevier, 2016
4. Bahga, A., Madisetti, V., "*Internet of Things: A Hands-on Approach Simulation"*, Published by Arshdeep Bahga & Vijay Madisetti, 2014
5. Larry Peterson, "*Computer Networks: A Systems Approach*", Morgan Kaufmann, 2011
6. George Coulouris et al.: "*Distributed Systems: Concepts and Designs*", Pearson, 5th edition, 2011

9. Correlation of course content with the demands of the labour market (epistemic communities, professional associations, potential employers in the field of study)

- the course follows the ACM and IEEE Curricula Recommendations for Computer Science studies (Computer Science 2023, Computer Engineering 2016, Information Systems 2020, Software Engineering 2014, Data Science 2021);
- the content of the course is treated accordingly with the national and European directives regarding the professional and transversal competencies (NQFHE)

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of the final grade
10.4 Course	• Achieving the discipline objectives • Proving the specific discipline competencies • Accurate and fluent use of specific terms	Topic description	25%
		Final evaluation by written examination	15%
10.5 Seminar/ laboratory/ project		Exercises	25%
		Formative evaluation by technical reports, projects, involvement activities	35%
10.6 Minimal performance standard			
• following the midterms of the formative evaluation;			

- identifying and presenting the main characteristics of the most popular internet working technologies and network application architectures;
- developing elementary IoT-based application for a basic sensor network

This course outline was certified in the Department Board meeting on …./…./….. and approved in the Faculty Board meeting on …../……./…….

Assoc Prof PhD Ion Gabriel STAN Dean	Assoc Prof PhD Nicusor MINCULETE Head Department .....
Lecturer PhD Anca VASILESCU Lecturer PhD Robert DEMETER ..... Course holders	Lecturer PhD Anca VASILESCU (Faculty MI) Lecturer PhD Robert DEMETER (Faculty IESC) ..... Holders of laboratory

Note:

1) Field of study – select one of the following options: BA/MA/PhD. (to be filled in according to the forceful classification list for study programmes);
2) Study level – choose from among BA/MA/PhD;
3) Course status (content) – for the BA level, select one of the following options: FC (fundamental course) / DC (course in the study domain)/ SC (speciality course)/ CC (complementary course); for the MA level, select one of the following options: PC (proficiency course)/ SC (synthesis course)/ AC (advanced course);
4) Course status (attendance type) – select one of the following options: CPC (compulsory course)/ EC (elective course)/ NCPC (non-compulsory course);
5) One credit is the equivalent of 25 – 30 study hours (teaching activities and individual study).