Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Advanced Software Technologies for Communications

2. Date despre disciplină

2.1 Course name (ro) (en)			Sisteme SW de management şi control integrat al reţelelor şi serviciilor				
2.2 Course Lecturer			Prof. Dr. Marius-Constantin Vochin				
2.3 Instructor for practical activities			Prof. Dr. Marius-Constantin Vochin				
2.4 Year of studies	2	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		DA	2.9 Course code	UPB.04.M3.O.09-52		2.10 Tipul de notare	Nota

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week	4	Out of which: 3.2 course	2	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	56	Out of which: 3.5 course	28	3.6 seminary/laboratory	28
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					45
Tutoring					0
Examinations					10
Other activities (if any):					0

3.7 Total hours of individual study	69.00
3.8 Total hours per semester	125
3.9 Number of ECTS credit points	5

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Computer Architecture, Computer Programming, Network Architectures and services, Switching and transmission technologies, Basics of operating systems
4.2 Results of learning	Associated with the domains mentioned above

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	This is not the case
5.2 Seminary/ Laboratory/Project	Mandatory attendance at laboratories (according to the regulation of university studies of master's degree in UPB).

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

To provide students with a knowledge base in the architectures and functionalities of subsystems of management and control used by network/service/content providers and operators in the context networks and integrated services for Internet networks of the next generation "Future Internet".

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	To develop students' skills in specification, design, implementation and operation/exploitation of M&C technologies specific to the Telecom field, of networks of computers/integrated and "cloud" type networks (TMN management systems, based on SNMP or Web/XML, autonomous network and service management, networks with architectures SDN). Both single- and multi-domain network contexts will be considered.
Transversal (General) Competences	**Works in a team and communicates effectively**, coordinating efforts with others to solving problem situations of medium complexity. **Autonomy and critical thinking**: the ability to think in scientific terms, to search and analyze data independently, as well as extract and present conclusions / identify solutions. **Ability to analyze and synthesize**: presents the acquired knowledge in a synthetic way, ca following a systematic analysis process.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* It lists the most important stages that marked the development of the field. Defines domain-specific notions. Describes/classifies notions/processes/phenomena/structures.

Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* Select and group relevant information in a given context. Work productively in a team. Elaborate a scientific text. Experimentally verify identified solutions. Solve practical applications. Interpret causal relationships appropriately. Identifies solutions and develops resolution/project plans. Formulate conclusions to the experiments carried out. Argue the identified solutions/workarounds.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Select appropriate bibliographic sources and analyze them. Respect the principles of academic ethics, correctly citing the bibliographic sources used. Demonstrates responsiveness to new learning contexts. Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities Demonstrates autonomy in organizing the learning situation/context or problem situation to solve Realizes the value of its engineering contribution to identifying solutions viable/sustainable to solve problems in social and economic life (responsibility social). Apply principles of professional ethics/deontology in analyzing the technological impact of solutions proposed in the specialized field on the environment. Analyzes and capitalizes on business/entrepreneurial development opportunities in the field of specialty.

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

The teaching is based on the use of the video projector (covering the communication and demonstration function); the oral communication methods used are the expository method and the problematization method, used head-on. The course materials are: course notes and presentations, proposed exercises. All materials are available in electronic format, through the course website.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction to the field of systems of management and control (M&C) for networks and services Basic M&C functions. The role of the management plan. The role of the control plan. Layered architecture of management and control.	2
2	M&C for Telecom Networks Functions, physical, informational and logical level layered TMN architecture. Basics languages for the abstract representation of M&C information (ASN.1). Examples of implementation. Signaling protocols (SS7, other protocols currently used for advanced services).	4

3	Current management and control solutions for the Internet SNMPv1/2/3 technology. RMONv1/2. MIB database, organization and access. Comparison of TMN and SNMP technologies. CMIP over TCP/IP	4
4	Cooperation between M&C entities in multi-domain complex systems for E2E services. "Business" models (suppliers/consumers). Notions about SLA contracts (Service Level Agreement) and negotiation protocols. Management of connectivity resources cross-domain. Performance evaluation. Examples. Security architectures for M&C systems.	6
5	Advanced management technologies Policy-based management. Technologies based on XML/WEB. Concepts and architectures for autonomous networks and services. Data representation. MAPE cycles. Examples.	4
6	New trends in M&C Concepts and methods of virtualization. The Impact of Virtualization on M&C. The model "Software Defined Networking - SDN" (the routing plan, the control plan, protocols OpenFlow, SDN switches). "Cloud" systems (types of services-IaaS, CaaS, PaaS, NaaS). NIST and ITU-T paradigms of M&C architecture for "cloud" systems. Resource reservation and allocation in "cloud" network contexts.	8
	Total:	28
Bibliography:		

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	SNMP (Simple Network Management Protocol)	4
2	Network node monitoring system - Nagios (SNMP)	4
3	Network node monitoring system – Nagios Remote Plugin Executor	4
4	Applications for monitoring Internet services: generator of advanced web statistics - MRTG (Multi Router Traffic Grapher)	4
5	Monitoring and management of host nodes using "Microsoft Active" technology directory"	4
6	Virtualization. VPN.	4
7	Final test	4
	Total:	28
Bibliography:		

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade

11.4 Course	Knowledge of theoretical notions fundamentals of M&C systems	Two written verification tests per semester, with theoretical and practical problems, sustained at fixed dates at the beginning the course; the weight of the two tests will be equal.	25
	Knowledge of the application mode of the M&C theory on architectures specific, contexts of network with various scenarios;	Note: knowledge checked on the second test can be covered by the first part of the course that was verified by the first test.	25
11.5 Seminary/laboratory/project	Knowledge of M&C concepts and of the way of use of related applications;	The laboratory test: a colloquium is composed in the final laboratory comprising a theoretical and a practical component. The theoretical component is verified by grid test; the practical component is evaluated by checking the mode of solution (implementation, testing, functioning) by the student of a specific practical M&C problem.	40
	The ability to solve problems and exercises	Continuous evaluation during the hours of seminar	10
11.6 Passing conditions			
obtaining a minimum score of 50% in both the theoretical assessment and the laboratory/seminar tests.			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

The relative cost of Management and Control systems for Telecommunications, Computer Networks or Networks with Integrated Services has grown continuously, driven directly by the complexity and the dimensions to which the development of these systems has reached. This is one of the main problems (still open) that operators and Internet service providers face today. Therefore, the use of more efficient, increasingly sophisticated, M&C systems, requires more and more staff specialized (engineers) able to understand and operate with them. Last but not least, the development and the evolution of current systems are strongly influenced by M&C operating requirements. Manufacturers of equipment need more and more engineers who are able to participate in activities of specification, design and implementation of M&C systems. This course provides answers to the current requirements in the M&C field mentioned above, by providing a necessary knowledge base to students to enable them to install/operate this type of system and furthermore to be able to specify, design and implement.

Another objective of the discipline is to set future specialists the necessary technical reference coordinates identifying the optimal solutions of management and control systems for networks and services in the context of an increasingly dynamic application markets.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Prof. Dr. Marius-Constantin Vochin	Prof. Dr. Marius-Constantin Vochin

Date of department approval	Head of department
26.09.2025	Conf. Dr. Serban Georgica Obreja

Date of approval in the Faculty Council	Dean
26.09.2025	Prof. Dr. Mihnea Udrea