

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Department	Power Engineering and Management
1.4	Field of study	Energy Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/ Qualification	Modern Power Systems - Cluj-Napoca in English
1.7	Form of education	Full time

2. Data about the subject

2.1 Denumirea disciplinei	Nuclear Power Plant Security			Codul disciplinei	21.00
2.2 Course responsible/ lecturer	Prof. dr. ing. Sorin Gheorghe Pavel; sorin.pavel@enm.utcluj.ro				
2.3 Teachers in charge of Seminars/ Laboratory/ Project	Conf. dr. ing. Horia Gheorghe BELEIU; horia.beleiu@enm.utcluj.ro				
2.4 Year of study	II	2.5 Semester	1	2.6 Type of assessment (E – exam, C – colloquium, V – verification)	E
2.7 Regimul disciplinei	DF – fundamental, DD – in the field, DS – specialty, DC – complementary				DS
	DI – compulsory, DO – elective, Dfac – optional				DI

3. Estimated total time

3.1 Number of hours per week:	3	of which	3.2 Course	2	3.3 Seminar	1	3.3 Laboratory		3.3 Project	
3.4 Total hours per semester	42	of which	3.5 Course	28	3.6 Seminar	14	3.6 Laboratory		3.6 Project	
3.7 Individual study:										
(a) Manual, lecture material and notes, bibliography									34	
(b) Supplementary study in the library, online and in the field									24	
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays									19	
(d) Tutoring									2	
(e) Exams and tests									4	
(f) Other activities									-	
3.8 Total hours of individual study <i>[sum (3.7(a) to 3.7(f))]</i>					83					
3.9 Total hours per semester <i>[sum of 3.4 and 3.8]</i>					125					
3.10 Number of credit points					5					

4. Prerequisites (where applicable)

4.1 Curriculum	Nuclear power plants
4.2 Competences	

5. Requirements (where appropriate)

5.1. For the course	Multimedia means
5.2. For the applications	On site

6. Specific competences

Professional competences	After completing the discipline, students: - will know the specific risk elements of NPP; - will know the objectives and requirements of nuclear security; - will be able to analyze and solve some problems specific to nuclear security; - will have mastered the basic requirements of the national legislation regarding the degree of nuclear security imposed on the NPP; - will know the problems specific to the human factor and their reflection in ensuring nuclear safety, in accordance with legal requirements; - will be able to apply the concepts, theories and fundamentals of nuclear security, specific measures and regulations.
Cross Competence	The correct choice and use of bibliographic sources, norms, standards and specific methods, under conditions of limited autonomy and qualified assistance, as well as supporting them with the demonstration of the capacity for qualitative and quantitative evaluation of some aspects related to the security of the NPP.

7. Expected learning outcomes

Knowledge	The student/graduate has in-depth knowledge of the principles of nuclear safety, the requirements for the safe design and operation of NPPs. He critically understands the national and international legislative and regulatory framework, the nuclear safety culture, the role of the human factor, radiological protection, radioactive waste management and emergency response measures. He knows the modern methods and practices used to maintain and continuously improve nuclear safety.
Skills	The student/graduate analyzes and evaluates the risks associated with the operation of a NPP, applies the principles and requirements of nuclear safety in solving specific problems in the field and interprets compliance with CNCAN regulations and international standards. Develops and argues solutions for the protection of personnel, the population and the environment, for the management of emergency situations and for the improvement of the nuclear safety culture.
Responsibility and autonomy	The student/graduate autonomously selects appropriate methods and tools for the analysis of nuclear safety aspects, assumes responsibility for the correctness of assessments and compliance with applicable regulations, and contributes responsibly to the development and promotion of nuclear safety culture. May participate in the coordination of safety analysis, monitoring and improvement activities within nuclear power facilities.

8. Discipline objectives (based on specific competencies acquired)

8.1	General objective	Gaining knowledge of nuclear security objectives and requirements
8.2	Specific objectives	• the nuclear power plant as a complex system; • national and international institutions and regulations; • the human factor and nuclear security; • interactions between the NPP and the environment; • NPP preventive maintenance; • nuclear energy and the human society; • nuclear security culture.

9. Contents

9.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
1	NPP general presentation - case study, U1 Cernavodă.	2		...

2	The main technical characteristics of the CANDU NPP.	2	Systematic exposure, theoretical and experimental demonstration, and discussions	
3	Nuclear safety (NS) principles used in nuclear facility design and processes implemented for NS control.	2		
4	Analysis of the NPP site in accordance with the requirements of the SN. Site characteristics monitoring program.	2		
5	Objectives, requirements and analyses of SN - limits and technical operating conditions. NPP compliance with CNCAN and international requirements.	2		
6	Ensuring the protection of personnel and the environment against ionizing radiation at the NPP. Program for the control of occupational radiation exposure. Program for planning and preparation for emergency response.	2		
7	Radioactive effluent and waste management. Gaseous and liquid radioactive effluent monitoring program. Radiological monitoring of the environment.	2		
8	Organization and management of NPP operation activities. Quality management system during NPP operation.	2		
9	Personnel training to maintain and increase the level of nuclear security and safety culture.	2		
10	Planning and preparing for the response to emergency situations specific to nuclear or radiological risk.	2		
11	Physical protection of the nuclear facility and materials. Protection against cyber threats.	2		
12	Types of cyber threats to nuclear power plants.	2		
13	SNN SA's strategy regarding the long-term operation of a NPP unit.	2		
14	Continuous improvement measures for SN and alignment with international standards. SN policy at Cernavoda NPP.	2		

Bibliography

- [1]. Societatea Națională Nuclearelectrică S.A. CNE Cernavodă, Raport de securitate Nucleară pentru Unitatea 1 de la CNE Cernavodă (Nuclear safety report for Unit 1/2 at CNE Cernavodă).
- [2]. Petre Ștefănescu, Reglementări și legislație nucleară. Ed. Bren, 2009.
- [3]. Petre Ștefănescu, Traian Mauna-Aren, Introducere în securitatea nucleară. Sistemul de management al calității. Ed. Bren, 2005.
- [4]. Petre Ștefănescu, Sorin Ghiță, Dan Șerbănescu, Securitate nucleară. Ed. Bren, 2002.

9.2. Applications - Laboratory		Number of hours	Teaching methods	Additional remarks
1	Organization and management of NPP exploitation activities.	2	PowerPoint slides presentation, theoretical and experimental demonstration, conversation, observation and analysis.	
2	he quality management system during the exploitation of a NPP	2		
3	The measures that ensure the maintenance and increase of the security culture level and nuclear safety for all categories of personnel.	2		
4	Continuous improvement of nuclear security and alignment with international standards and best practices.	2		
5	Planning and preparing the NPP response to emergency situations specific to nuclear or radiological risk.	2		
6	Physical protection in the context of nuclear safety culture.	2		

7	Ensuring protection against cyber threats.	2		
Bibliography [1]. Societatea Națională Nuclearelectrică S.A. CNE Cernavodă, Raport de securitate Nucleară pentru Unitatea 1 de la CNE Cernavodă (Nuclear safety report for Unit 1/2 at CNE Cernavodă). [2]. Petre Ștefănescu, Traian Mauna-Aren, Introducere în securitatea nucleară. Sistemul de management al calității. Ed. Bren, 2005.				

10. Alignment of course content with expectations of the epistemic community, professional associations, and representative employers in the field

The content of the subject and the skills acquired correspond to the expectations of the relevant professional organizations and the relevant companies where the students carry out their internships and/or take up a job, as well as the national quality assurance agencies (ARACIS)
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11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade (%)
11.4 Course	Understanding criteria and phenomena, engaging in discussions, formulating questions, participating in consultations, the ability to solve concrete applications.	Written exam (E) – grid,	70 %
11.5 Seminar	The ability to apply in practice, in different contexts, the acquired knowledge.	Tests during the semester.	30 %
10.6 Minimum standard of performance: final mark to be greater than 5.			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
September 2024	Course	Prof. Eng. Sorin PAVEL, PhD	
	Applications	Conf. Eng. Horia Gheorghe BELEIU, PhD	

Date of approval in the council of the Department of Power Engineering and Management September 2025	Head of Department: Assoc. Prof. Eng. Horia G. BELEIU, PhD
Date of approval in the Faculty of Electrical Engineering Council September 2025	Dean: Assoc. Prof. Eng. Andrei C. CZIKER, PhD