STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Reliability and Safety of Engineering Systems		**1010102231010133958**
Field of study	Profile of study (general academic, practical)	Year /Semester
Environmental Engineering Second-cycle	**(brak)**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Water Supply, Water and Soil Protection	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
Second-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **15** Classes: **-** Laboratory: **-** Project/seminars: **-**		**1**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
(brak)	**(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**1 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Mathematical logic, combinatorics and probability theory, random variables, probability distributions of typical random variables at the 6th KRK level
2	**Skills**	Identification of random variables, probability calculation of random events, calculations of expected values of discrete and continuous random variables at 6th KRK level
3	**Social competencies**	Consciousness of necessity of permanent updating extending of skills and knowledge

Assumptions and objectives of the course:

To transfer basic knowledge about relationship between designing rules and reliability of technical systems. To present methods of reliability assessment of environmental engineering systems and elements. To provide knowledge about identify of hazard related to incorrect operation of technical systems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows and understand definitions of basic reliability parameters of technical systems and their applications - [K2_W04]

2. Student has systematic knowledge about reliability structures of technical systems and about properties of these structures - [K2_W04, K2_W06]

3. Student knows basic methods for reliability analysis of technical systems such as ?Event Tree Analysis? and ?Fault Tree Analysis?. - [K2_W04]

4. Student understands the concept of ?risk? in safety engineering and knows basic rules of risk estimation in engineering - [K2_W04, K2_W06, K2_W08]

Skills:

1. Student is able to recognize reliability structure of simple technical system and to estimate value of its reliability - [K2_U11, K2_U16, K2_U17]

2. Student can calculate reliability parameters of typical engineering structures - [K2_U11, K2_U16, K2_U17]

3. Student is able to apply ?Event Tree Analysis? and ?Fault Tree Analysis? for risk calculations of technical systems - [K2_U11, K2_U16, K2_U17]

4. Student can calculate risk of technical system operation and is able to show method of the risk reduction - [K2_U11, K2_U16, K2_U17]

Social competencies:

1. Student understands necessity of collective work in order to solve problems of reliability and safety in environmental engineering - [K2_K03]
2. Student is aware of necessity of permanent development of his professional skills and competence - [K2_K01]
3. Student is able to inform the society about reliability and safety problems of contemporary environmental engineering systems - [K2_K07]

Assessment methods of study outcomes

Written final test (3 questions to answer and one problem to solve),
Permanent evaluation at lectures (rewarding students for activity).

Course description

Foundations of reliability analysis. Reliability investigation rules. Reliability factors ? their selection for environmental engineering systems operation assessment. Reliability of technical systems. Statistics methods in technical systems failure analysis. Failure analysis of technical systems in design and operation requirements context. Criterions of technical systems reliability estimation. Alternative solutions in environmental engineering from reliability point of view. Definition of risk and safety, risk assessment and safety estimation, risk and safety management, human factor in risk. Basic methods for reliability analysis of technical systems. ?Event Tree Analysis? and ?Fault Tree Analysis?.

Basic bibliography:

1. Bobrowski D.: Elementy teorii prawdopodobieństwa. Wyd. PP, Wydanie III rozszerzone, Poznań 1976
2. J. Bucior, Podstawy teorii i inżynierii niezawodności. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2004
3. J. R. Rak, B. Tchórzewska-Cieślak, Metody analizy i oceny ryzyka w systemie zaopatrzenia w wodę. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2005
4. B. Tchórzewska-Cieślak, Niezawodność i bezpieczeństwo systemów komunalnych (na przykładzie systemu zaopatrzenia w wodę). Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2008
5. Woliński S., Wróbel K.: Niezawodność konstrukcji budowlanych. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2001

Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Participation in consultations related to the lectures	3
3. Preparation for the exam and the present at the exam	15

Student's workload

Source of workload	hours	ECTS
Total workload	33	1
Contact hours	18	1
Practical activities	0	0